# PUBLIC WORKS

Jan. 1956

## CITY, COUNTY AND STATE

Public Works News from WASHINGTON page 26

What You Should Know about the Design and Location of CULVERTS page 83

ANTI-LITTER CAMPAIGN Details of a program for a big city that can be scaled down to your needs page 96

How to Design an OFF-STREET PARKING LOT page 100

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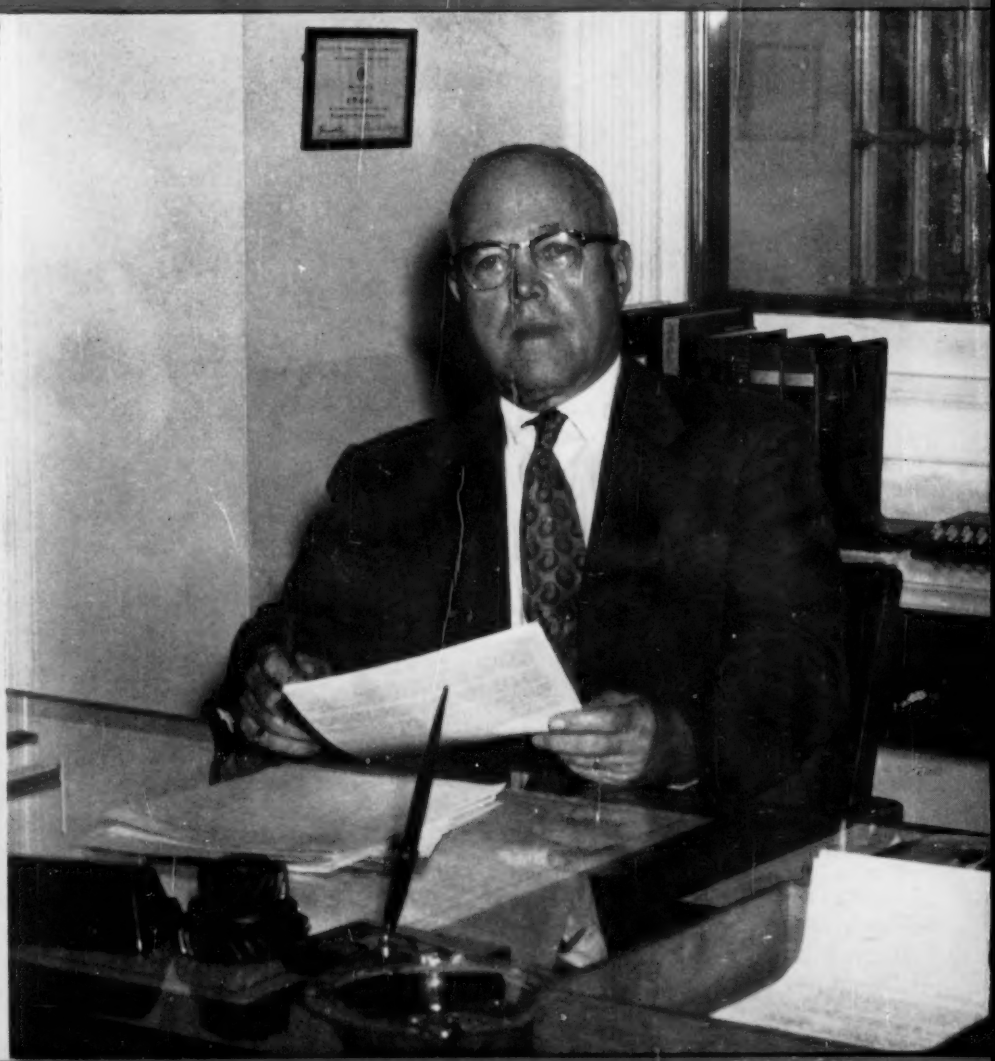


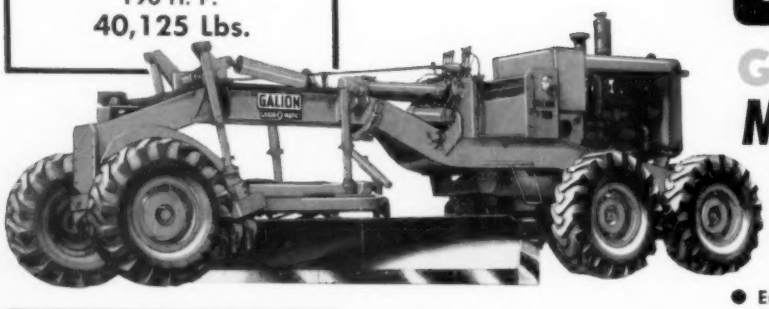
Charles W. Cooke, shown here in his office, is Director of Public Works for Hartford, Conn. He has served this city since 1914 and has a long and distinguished record of engineering activity. More data on page 22.

# SMASHING PERFORMANCE RECORDS!

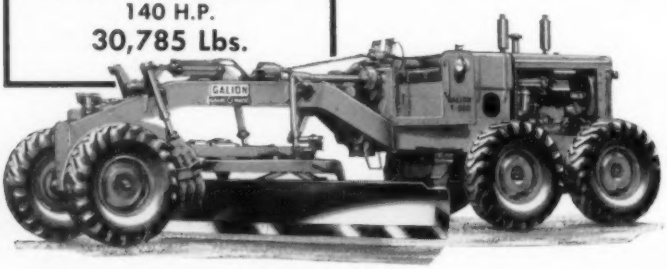
## WEIGHT FOR WEIGHT
# GALION
## GRADE-O-MATIC* MOTOR GRADERS

*Give you most "PUSH-POWER" at the BLADE Where it counts!*

**Model T-700**
190 H. P.
40,125 Lbs.

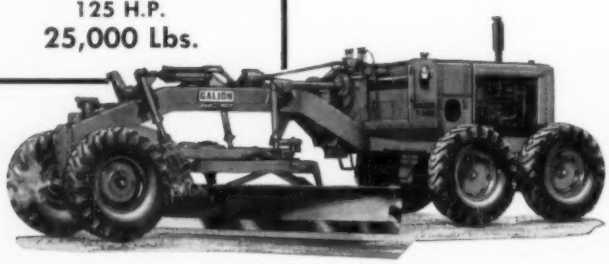


**Model T-600**
140 H.P.
30,785 Lbs.



*Utilizing a Torque Converter and Power-Shift Transmission.

**Model T-500**
125 H.P.
25,000 Lbs.



*(Each weight with Scarifier)*

- Engineered balance of power, weight and blade pressure — prevents useless spinning of drive wheels, moves more material, in quicker cycles, with less operator fatigue.
- GRADE-O-MATIC Drive provides tremendous torque multiplication — automatically as needed; absorbs load shocks, prevents engine lugging and stalling.
- GRADE-O-MATIC Drive eliminates the foot clutch and provides effortless, automatic gear shifting — on the go — while moving in either direction.
- GRADE-O-MATIC Drive automatically adjusts engine speed to meet all loads or conditions — at any predetermined working or travel speed.

### *THE LAST WORD IN GRADER PERFORMANCE and VALUE*

"PUSH-POWER" at the blade is the power that counts in rating the efficiency and work production value of a motor grader. With this kind of smooth, shockless power transmission, effortless shifting, and balance of weight to horsepower, you get more work done — easier — than you ever thought possible.

You'll never believe a Galion GRADE-O-MATIC Grader does so much until you own one and put it to work.

**OTHER GALION MOTOR GRADERS**
Models 118, 104, 450, 303, 503.
*Write for literature*

ESTABLISHED GALION 1907

**MOTOR GRADERS · ROLLERS**

TRENCH ROLLERS · PORTABLE ROLLERS · 3-WHEEL ROLLERS · TANDEM ROLLERS · MOTOR GRADERS

THE GALION IRON WORKS & MFG. CO., General and Export Offices, Galion, Ohio, U. S. A.
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# CRP*

CATALYTIC
REDUCTION
PROCESS

## provides exclusively highest solids loading for sludge digestion

### RESULTING IN:

1. Smaller tanks
2. 1/3 to 1/7 of former digester volume for biological requirements of sludge digestion* (Contrasted to actual requirements of former methods of digestion).
3. Non-formation of dense floating solids, termed "scum", eliminating former pro-ration of digester volumes for holding "scum".
4. Consistently highest degree of volatile solids reduction and gas production — through fundamental application of a simple gas diffusion mechanism — with lowest tank volume and simplified piping, without increase in operation supervision requirements.

**Exclusive of sludge storage volume that may be required by subsequent disposal methods.*

***Reports Available***

**Reports describing the PROCESS in detail are available on request. Write to Department F.**

**Patents Applied For*

**CHICAGO PUMP COMPANY**
Subsidiary of Food Machinery and Chemical Corporation
**SEWAGE EQUIPMENT DIVISION**
622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Flush Kleen ®, Scru-Peller ®, Plunger, Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers . . . Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Barminutor ®, Comminutors.

Now's the time to mail this month's Readers' Service Card.

# —THE NO. 12 DOES A JOB

These two pictures, one taken in June, the other in February, show the same CAT* No. 12 Motor Grader at work for the City of Kellogg, Idaho. Whether there are streets to be graded or snow to be cleared, this big yellow grader does the job well.

"It's a wonderful machine," says Tom Olson, Street Superintendent. "And wonderful is the word for Caterpillar dealer service, too. Together they keep us sold on Caterpillar products."

The No. 12 is now available with new hydraulically actuated plow and wing. This means faster movement of the wing and down pressure to the snow plow when needed. A completely new hydraulic system powers these attachments.

But it is the machine behind the plow that makes this unit so effective for snow removal. It has exceptional traction, and the exclusive gasoline starting engine gives you positive starting no matter how low the temperature drops. The oil clutch in the Cat No. 12 means disc replacement and clutch fade are practically eliminated and maintenance is drastically reduced.

Ask your Caterpillar Dealer to demonstrate the versatility of his motor graders today. See for yourself why they are ready to slug it out with snowdrifts in the winter and work the year around building and maintaining streets. He has the right motor grader to fit your needs and budget.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

**CATERPILLAR***

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

**99% OF ALL CAT MOTOR GRADERS EVER BUILT ARE STILL AT WORK**

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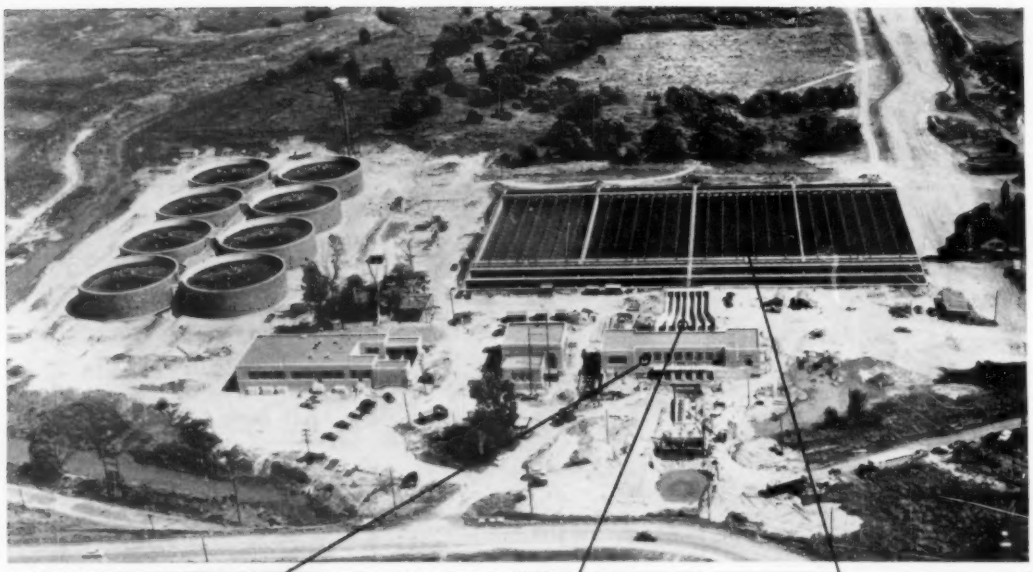
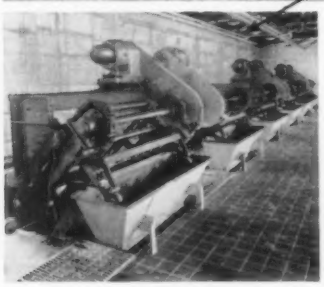
**THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES**





Six Link-Belt inclined bar screens, each with eight rakes, discharge screenings onto steel belt conveyor.

Sewage from grit and screen building flows into six grit channels, where grit settles and is removed by L-B grit collectors and washing-dewatering screw conveyors.

Primary settling tanks use Link-Belt longitudinal and cross collectors, scum skimmers and drives.

### Philadelphia's Southwest Sewage Works demonstrates

# how to keep treatment capacity ahead of population growth

FORESIGHT was a key element in planning this new Philadelphia sewage plant. It had to provide practical waste treatment for a population of 870,000 — yet be able to serve the estimated 1,200,000 expected by 1970. Working with city engineers, Link-Belt helped supply the efficient screens, grit collectors and sludge collectors to handle 136 mgd.

This $8 million plant is part of Philadelphia's ten-year, $80 million program for the elimination of stream pollution. Link-Belt Straightline Collectors were also chosen for the Northeast Works with a capacity of 125 mgd, completed in 1951 as the first phase in this huge project.

Whether you're concerned with large municipal or small industrial waste treatment . . . or need the finest in modern water purification equipment — count on Link-Belt to provide maximum efficiency at all flow conditions. Our engineers can call on a complete line of equipment . . . will work with you, your chemists and consultants.

**LINK-BELT**

**SANITARY ENGINEERING EQUIPMENT**

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 13.944

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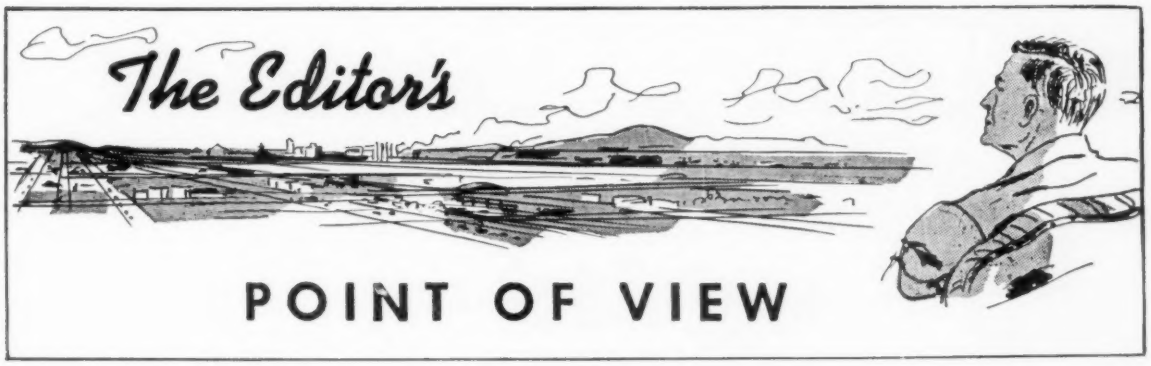


### Conserving Engineering Skills by Better Organization and Administration

THAT THERE is a shortage of engineering skills we all know; and because of the length of time it takes to train an engineer, there is no quick and easy way of solving the problem. It is possible, however, to make far better use of the engineers we have. In nearly every organization, some engineers are doing work that does not require engineering training or experience. It is time to review present-day staffs, to determine those positions that must be filled by qualified engineers and those which need not be. In some, perhaps many, cases this will also permit some up-grading of engineers by promotion to higher-level positions not now filled.

Wisely done, such a review of the work programs may provide adequately for the future for the young men, non-engineers, now being brought into many engineering staffs as a stop-gap measure to abate the present shortage. By and large, it is not a sound procedure to build up a group that will, with exceedingly few exceptions, never become qualified engineers. Immediate necessity may, in some cases, justify this procedure, though we believe that in many instances the steps outlined above will meet present needs better. In any case, thoughtful consideration of that future problem—what to do with these semi-engineers a few years hence—might turn these potential question marks into positive assets.

### Getting Values from Refuse; Is It only a Dream?

THERE ARE few public works officials who are not interested in making refuse collection and disposal pay its way; yet there is perhaps no single city in this country that can now say that it is reaching this goal. The scope of research and test projects over the past few years are an indication of the interest that exists. We get a good many reports on experimental and test installations; we believe that the problem will eventually be solved, especially in the larger communities where refuse production is great enough to produce a reasonably large return of salable material. We believe that the successful process will have to be quick in action, for no community dares to store several weeks' supply of refuse, nor is the space usually available in which to store it; the process will have to use a minimum of labor and simple equipment or machinery, skilled supervision will be necessary; plant and equipment must not be unduly costly; and operations cannot be a nuisance in the area.

No process has been reported to us as yet which seems to meet these general essentials; but we still examine each new report with hope and anticipation. Refuse collection and disposal is one of the costliest and most difficult of our municipal functions. It is only comparatively recently, after nearly four decades of neglect, that it has been attacked by well-trained engineering minds. The future is promising; much has been accomplished; but there is still much to do.

### Putting Those Electric Power Transmission Lines Underground

SOME TIME back we proposed that a start be made on putting electric power distribution lines underground, and we were promptly set back in our place by several dyed-in-the-wool power folks who said it was all foolishness and not needed at all. Yet it seems to us that some facts are established: Electric power to-day has become as essential and necessary part of living as a city water supply was thirty or forty years ago—and maybe more; and after every windstorm, tornado, hurricane or ice storm—and we have plenty of these each year—the newspapers carry the news that forty thousand or a hundred thousand or some other fantastic number of families are without power and will be without it for one, two or three days. We have personally been without power as long as five days, and in cold weather. Just so long as wires are strung hither and yon, under and through trees, there will be such serious interruption of power after every storm, even moderate storms. It seems to us that our stand-pat electric power officials ought to start right now to think about initiating a program, or developing a method that will minimize breakdowns, and reduce and speed up the task of restoring power after such breakdowns occur to provide needed security to power users. To us, untutored in what can't be done, putting lines underground would be a good start.

# THE MEMBERSHIP OF A

**96%** OF ALL 6-INCH AND LARGER CAST IRON WATER MAINS EVER LAID IN 25 REPRESENTATIVE CITIES ARE STILL IN SERVICE.
Based on the findings of a survey conducted by leading water works engineers.

# CAST IRON PIPE

Now's the time to mail this month's Readers' Service Card.

# DISTINGUISHED CLUB...

**The Cast Iron Pipe Century Club** is probably the most unusual club in the world. Membership is limited to municipal, or privately-owned, water and gas supply systems having cast iron mains in service for a century or more. Although the Club is formally constituted, there are no dues, no regular meetings, and no obligations other than to inform the Recording Secretary if and when the qualifying water or gas main is taken out of service, or, sold for re-use.

In spite of the unique requirements for membership, the Club roster grows, year by year, from 18 in 1947 to 73 in 1955. Members comprise 38 *water* and 35 *gas* utilities, in cities large and small, from the Pacific to the Atlantic, from Canada to the Gulf.

If your records show a cast iron main in service, laid a century or more ago, the Club invites you to send for a handsome framed Certificate of Honorary Membership. Address Thomas F. Wolfe, Recording Secretary, Cast Iron Pipe Century Club, Peoples Gas Bldg., Chicago 3, Illinois.

## C. I. P. CENTURY CLUB NOW HAS 73 MEMBERS!

ALBANY, New York
Department of Water and Water Supply
ALBANY, New York
Niagara Mohawk Power Corp. (Gas)
ALEXANDRIA, Virginia
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*ALLENTOWN, Pennsylvania
Bureau of Water
BALTIMORE, Maryland
Bureau of Water, Dept. of Public Works
BALTIMORE, Maryland
Consolidated Gas Electric Light and Power Co.
BOSTON, Massachusetts
Public Works Dept., Water Division
BOSTON, Massachusetts
Boston Consolidated Gas Co.
BOUND BROOK, New Jersey
Public Service Electric & Gas Co.
BRIDGEPORT, Connecticut
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CINCINNATI, Ohio
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Columbia Water Company
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FREDERICK, Maryland
Frederick Gas Company, Inc.
CITY OF FREDERICKSBURG, Virginia
Gas Department
HALIFAX, Nova Scotia
Public Service Commission, Public Water Supply
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The Hartford Gas Company
HARTFORD, Connecticut
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*New Members in 1955

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SALEM, Massachusetts
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*SPRINGFIELD, Illinois
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WILMINGTON, Delaware
Wilmington Water Department
WINCHESTER, Virginia
Water Department
WINSTON-SALEM, North Carolina
Water Department
YORK, Pennsylvania
York Water Company
ZANESVILLE, Ohio
Water Department

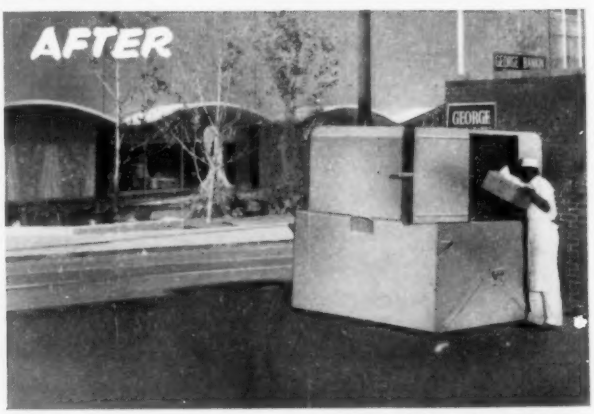
# SERVES FOR CENTURIES

Thousands use our Readers' Service card to keep up to date . . . do you?

# Look what's happening

Here is Plainview's Dempster-Dumpster serving one of its 58 Detachable Containers.

TWO PHOTOS at bottom of page serve as typical examples of scenes, wherever trash and refuse are collected, BEFORE and AFTER a Dempster-Dumpster Container is installed.




**DEMPSTER**

5115

# to bulk refuse collection!

**Cities, large and small, installing Dempster-Dumpster System featuring large capacity fire-proof, scavenger-proof steel Detachable Containers. Scores of them handled by only one man . . . cutting cost tremendously!**

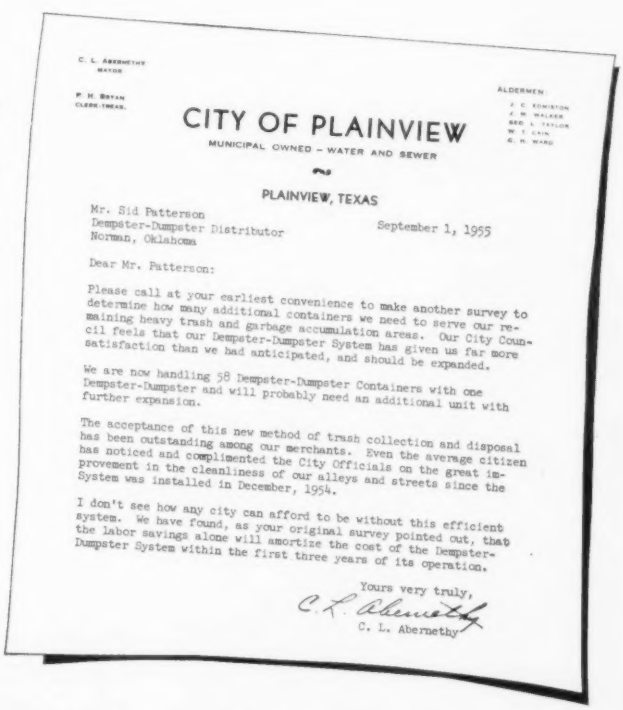
THERE IS A WAY to eliminate your bulk refuse handling problem . . . open cans, crates and boxes with overflowing refuse . . . rats feeding on it . . . wind scattering loose rubbish . . . dogs and cats munching in the mess . . . flies buzzing around the stuff—a costly potential in disease and fire hazards alone in damage to persons and property. And, the equipment and labor cost of collection is tremendous. There's a simple, economical and nationally recognized solution to this problem. Big steel Dempster-Dumpster Containers located at convenient bulk refuse accumulation points—each equivalent to 75 ordinary trash cans—in your business areas . . . in housing and apartment areas . . . at schools, hospitals, etc. Scores of them—25, 30, 40, 50—served on schedule by only one man, the driver of your truck-mounted Dempster-Dumpster.

You can understand why officials like Mayor Abernethy of Plainview say: "I don't see how any city can afford to be without this efficient system." Praiseworthy satisfaction is the result in other cities—Borger, Pampa, Odessa and Lubbock in Texas, for instance. Atlanta . . . Baltimore . . . Davenport, Iowa . . . Henderson, Ky. . . . Jackson, Tenn. . . . Lakeland, Fla. . . . Wilmington, N. C. . . . Richmond, Va. . . . Rochester . . . New York City . . . Denver . . . Montgomery, Ala. . . . Wyandotte, Michigan and many, many others.

Invariably, wherever this system is installed, one finds immediate praise of an outstanding improvement from merchant users and citizens alike. Without question, the Dempster-Dumpster System is recognized as the most sanitary and lowest cost method of bulk refuse collection ever devised. Ask us to send you complete information. Write today! Manufactured exclusively by Dempster Brothers, Inc.

## "How can any city do without it --" says Plainview's Mayor Abernethy.

Wherever the Dempster-Dumpster System is in use, satisfaction beyond that anticipated is the same as expressed here by Mayor Abernethy. Your city, too, can save thousands of dollars and, at the same time, eliminate fire and health hazards and improve the cleanliness and appearance of your heavy producing districts with this amazing system. A survey of your bulk refuse collection may be arranged without obligation.



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J. M. WALKER
GEO. L. TAYLOR
W. T. CAIN
C. H. WARD

CITY OF PLAINVIEW
MUNICIPAL OWNED – WATER AND SEWER

PLAINVIEW, TEXAS

Mr. Sid Patterson
Dempster-Dumpster Distributor
Norman, Oklahoma

September 1, 1955

Dear Mr. Patterson:

Please call at your earliest convenience to make another survey to determine how many additional containers we need to serve our remaining heavy trash and garbage accumulation areas. Our City Council feels that our Dempster-Dumpster System has given us far more satisfaction than we had anticipated, and should be expanded.

We are now handling 58 Dempster-Dumpster Containers with one Dempster-Dumpster and will probably need an additional unit with further expansion.

The acceptance of this new method of trash collection and disposal has been outstanding among our merchants. Even the average citizen has noticed and complimented the City Officials on the great improvement in the cleanliness of our alleys and streets since the System was installed in December, 1954.

I don't see how any city can afford to be without this efficient system. We have found, as your original survey pointed out, that the labor savings alone will amortize the cost of the Dempster-Dumpster System within the first three years of its operation.

Yours very truly,
C. L. Abernethy
C. L. Abernethy

**BROTHERS 916 Dempster Bldg., Knoxville 17, Tennessee**

A PICTURE REPORT OF

# INTERNATIONAL POWER

## Boosting job production everywhere

**Morrison-Knudsen Co.** and Landers & Griffin Inc., joint venturers on $17,000,000 Portsmouth (New Hampshire) Air Base, are laying 423,000 cu. yds. of concrete with this spreader. Its 10 International-powered vibrators continuously work a strip 25 ft. wide, 14 inches thick. All concrete is being laid for 200 x 11,620 ft. runway and 1,000 x 8,500 ft. apron. Also on the 5,788,000-yd. job are 6 TD-24 torque converter pushers and 16 self-propelled scrapers. Their output on 10,000-ft. cycles averages 1,400 pay yds. hourly.

**This International "300"** tractor is economically doing a job normally assigned a much bigger, more expensive machine . . . moving 1000 cu. yds. Heaping 8 cu. ft. of sandy loam per load, it completes a 100-ft. cycle every 1½ minutes. "300" is building a running track for a school in Greenville, Mississippi, will take 7 to 10 days.

**3000-ft. cycle every 3 min.** is the record of Western Construction Co's "55" Payscraper. This includes time for TD-24 to push-load 10 pay yds. of ripped caliche. Area, near El Paso, Texas, was once considered too steep and rocky for development. Soon, thanks to International power, it will be graded and terraced for 250 quarter-acre lots.

**"Ideal for dozing rock,"** says Paul Weaver, Supt. for Joe Wenke Quarries, of this veteran TD-14A. "We use it continuously for shovel and quarry-floor cleanup. Performance has been excellent. Downtime is way down, due partly to rugged construction, partly to prompt parts delivery service from our International distributor." Quarry, located at Toledo, Iowa, produces 200 tons of 1-inch road stone per hour.

**Fast on job, fast between jobs**—Handling all tractor work in a quarry near Denver, Colorado, 200 hp TD-24 saves time by driving job-to-job at 7.8 mph. Output, 2200 tons of 1¼-inch stone per 8-hour shift, is taken from crusher by International-powered belt conveyor, background, then stockpiled by TD-24. Unit also does all stripping.

**Ripping 150 yds. of concrete** in front of a Camden (New Jersey) filling station was a job too tough for a ¾-yd. shovel, according to engineers. Al Pangia's International Drott TD-14A, however, did the work unassisted. Unit's tremendous break-out force, 17,000 lbs, broke up the slab . . . even tore out 5-ft. concrete footings.


# International
makes every load a pay load

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# Industrial Power

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CRAWLER TRACTORS
8 Models . . 40 to 200 hp

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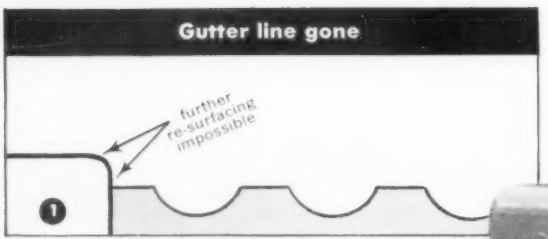
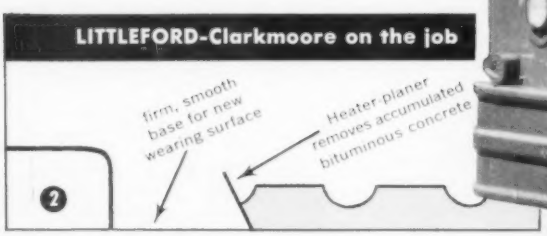
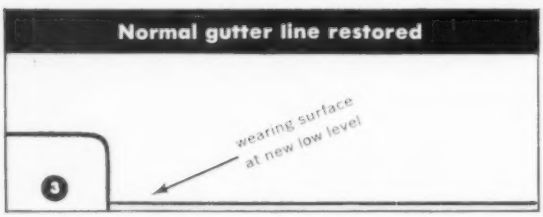
6 Models . . . 9 to 59 dbp

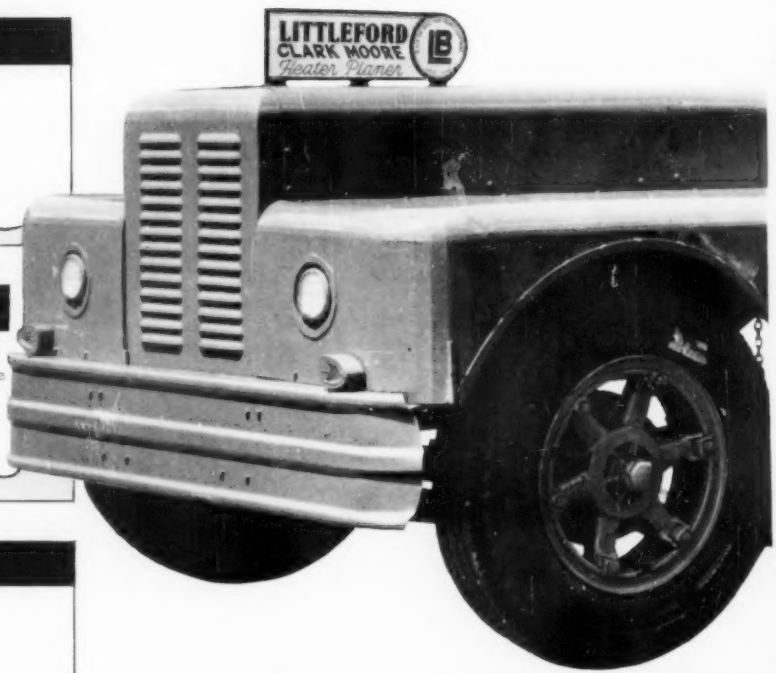
ALSO: International Drott Loaders . . . International Scrapers, Bottom-Dump Wagons . . . and International Superior Pipe-Boom Tractors.

# Save 63¢ yd. on Black

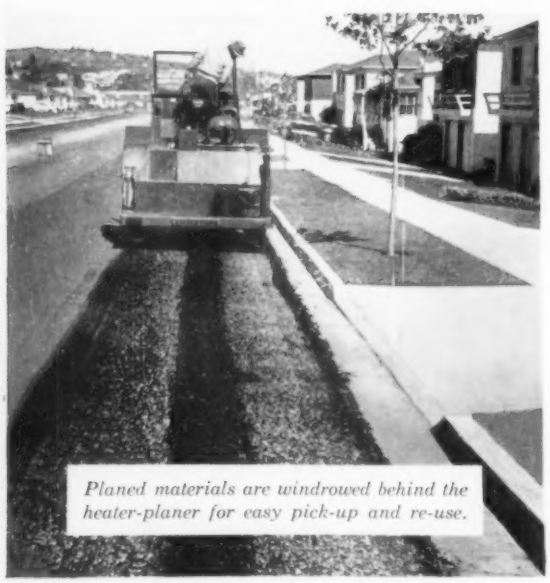




LITTLEFORD-Clarkmoore on the job
firm, smooth base for new wearing surface
Heater-planer removes accumulated bituminous concrete
2




## use the LITTLEFORD



*Planed materials are windrowed behind the heater-planer for easy pick-up and re-use.*

The Littleford-Clarkmoore Heater-Planer planes the road surface so smooth you can lay the surface course directly on it . . . thus introducing a whole new technique in road maintenance.

This ingenious giant — at last — permits complete re-surfacing of city streets. Adequate maintenance has been impossible heretofore because of the lack of an efficient tool for removing excess bituminous concrete accumulated layer on layer, year after year.

Now the Littleford-Clarkmoore Heater-Planer not only removes the excess material, it also heats and planes a firm, smooth base for the new surface and helps keep it at the proper level.

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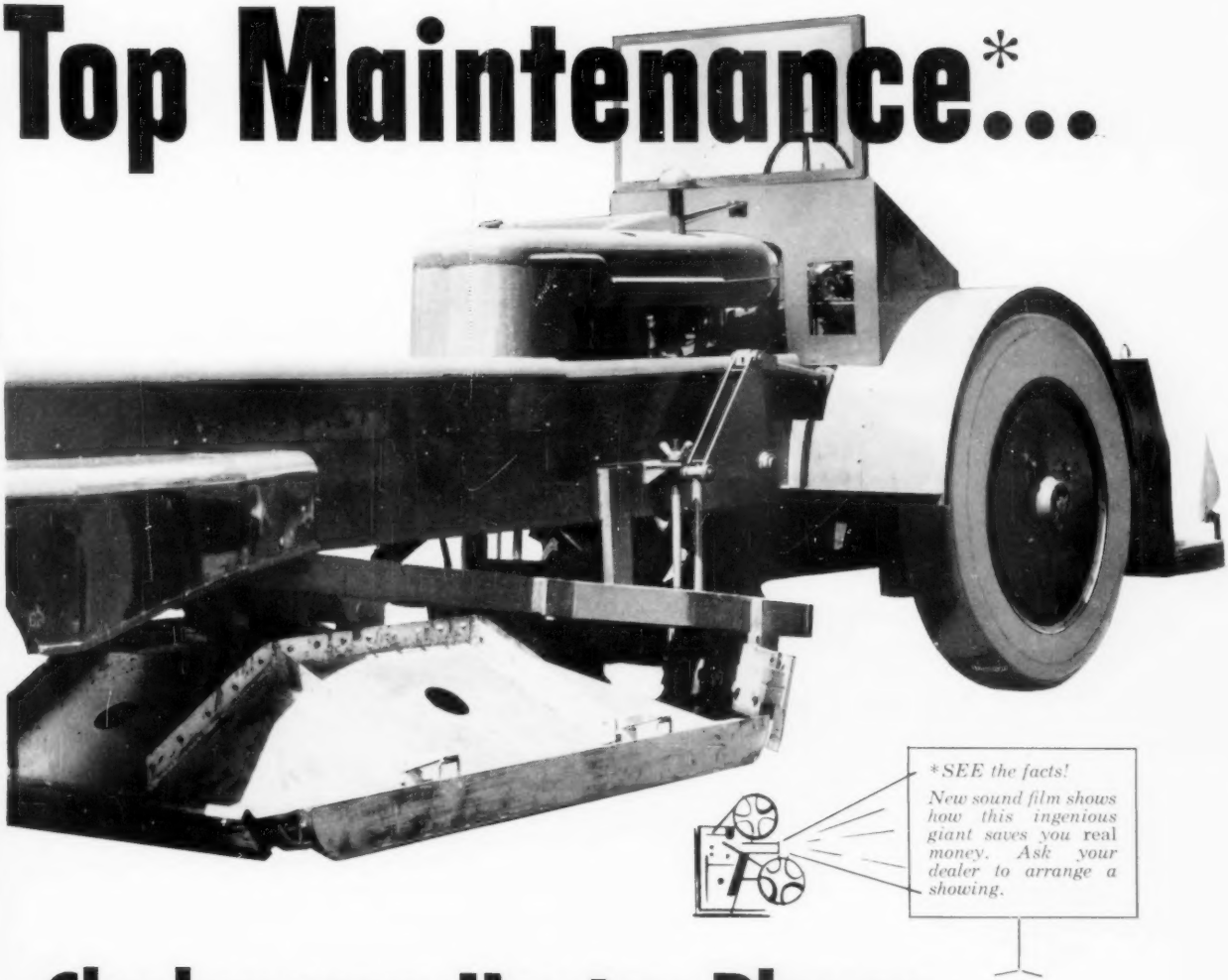

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# -Clarkmoore Heater-Planer

The efficiency of the Littleford-Clarkmoore Heater-Planer comes from this unique combination of Littleford engineered advances:

- ★ hydraulic creeper gear drive that moves the Heater-Planer smoothly and steadily at all speeds from 8-inches up to 35-feet per minute, yet keeps the engine running at a constant 1200 rpm.
- ★ planing depth that ranges from a skin cut to 1″ thick.
- ★ overlapping double-bladed planing action that covers a path 81″ wide and windrows the material for pick-up and re-use.
- ★ ingenious heating system that provides a balanced ratio between heat penetration and forward speed.

And don't forget the many other uses of the Littleford-Clarkmoore Heater-Planer:

- ★ Levels out troughs on straight-aways.
- ★ Smooths out corrugations on hills, at traffic lights and stop signs.
- ★ Planes off top surface to prepare for surface treatment.
- ★ Removes fatty sections or slippery places.
- ★ Roughs up bad hills to avoid skidding.

Before you buy, check the Littleford-Clarkmoore. You'll find it the perfect tool for better black top maintenance. Write for bulletin FF-18. Littleford Bros., Inc., 452 E. Pearl St., Cincinnati 2, Ohio.

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SINCE
1861

LUDLOW

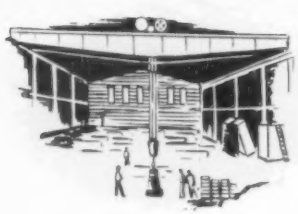
# How the consolidation of **two great valve companies** can help you

In January, 1955, two great valve companies consolidated their resources. They had been neighbors in Troy, New York and friendly competitors for two thirds of a Century. The names remain the same but Rensselaer became a Division of The Ludlow Valve Manufacturing Company — All now under one management in one plant, with unit responsibility to its customers.

## THE BEST IN DESIGN

You, the Water Works Executives are the final judges. You have cast your ballots in the form of extensive purchases over the last half century. In many cases the result is obvious, but your opinions on A.W.W.A. valves and hydrants vary. Therefor both lines will be continued and any Representative of the combined companies can show you the characteristics of each. In the meantime our search for ever-better valves goes on.

## THE BEST IN PRODUCTION



The production facilities of the combined Companies have been consolidated and at the same time are being greatly expanded. Only the newest, most modern equipment has been retained. Hundreds of thousands of dollars worth of new equipment is expanding the capacity and giving even greater assurance of our ability to serve. This means insurance for you, more local stocks to draw on, and shorter deliveries on heavy equipment. This all means lower inventories for you.

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SINCE

# 1885 —Rensselaer

## THE BEST IN EXPERIENCE

The combined Companies have had experienced engineers in the field in every State of the Union for a total of 165 years of service. These men have helped you, you have helped them, and in turn they have helped many others. The results of this close contact over a long period have been reported back and catalogued to become an up-to-date "Encyclopedia" for the Water Works field.

## THE BEST IN SALES ENGINEERING

Sales Engineering in the field backed by the extensive fund of knowledge in the home office is the art of locating the right product in the right place at the right time, with the lowest possible cost and installation time. In most cases an error in the original selection can cost far more in digging, flooding or stoppages, than the original equipment. In other cases, the sales engineer may make important savings in the installation cost. The Ludlow and Rensselaer Sales Engineers and the "Encyclopedia" are at your service.

## AND THE TRADITIONS GO ON

The names, Ludlow and Rensselaer mean the same today that they have during your lifetime. The desire to serve the Water Works Field in person —in research and design and in prompt delivery of original equipment and spare parts for all products has not changed. On the other hand, our ability to serve has at least doubled.

We shall appreciate the opportunity to explain in person what all of this means to you.

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# 700-TON

# USS STRUCTURAL STEEL FRAMEWORK

The Structural Steel framework nearing completion. The 700 tons of Structural Steel were fabricated and erected by American Bridge.

## – erected in only 5 weeks!

All connections between Structural Steel members were made with high tensile bolts. This not only speeded-up erection, but made the job unusually quiet.

This ultra-modern, rampless parking garage—one of the most unusual ever constructed—was erected by the Public Parking Authority of the City of Pittsburgh in a drive to improve downtown parking facilities.

In area, the new garage is 120-feet wide by 220-feet long, incorporating six levels for drive-in parking. The 120′ x 125′ center section of the structure is on a slope, while the two 120′ x 47′6″ end sections are level. The slightly tilted floors eliminate the necessity for ordinary driveway type ramps. Parking capacity of the garage is 812 cars.

The total 700 tons of Structural Steel for the framework were erected and field-connected with high tensile bolts in just five weeks. A fast job— true. But Structural Steel has made a habit of setting construction records . . . in *speed*, in *economy*, and in *architectural versatility*. Regardless of what type of municipal project you might undertake; schools, government buildings, or even airports, you won't find a stronger, safer, more practical construction material than Structural Steel. Look at this list of advantages:

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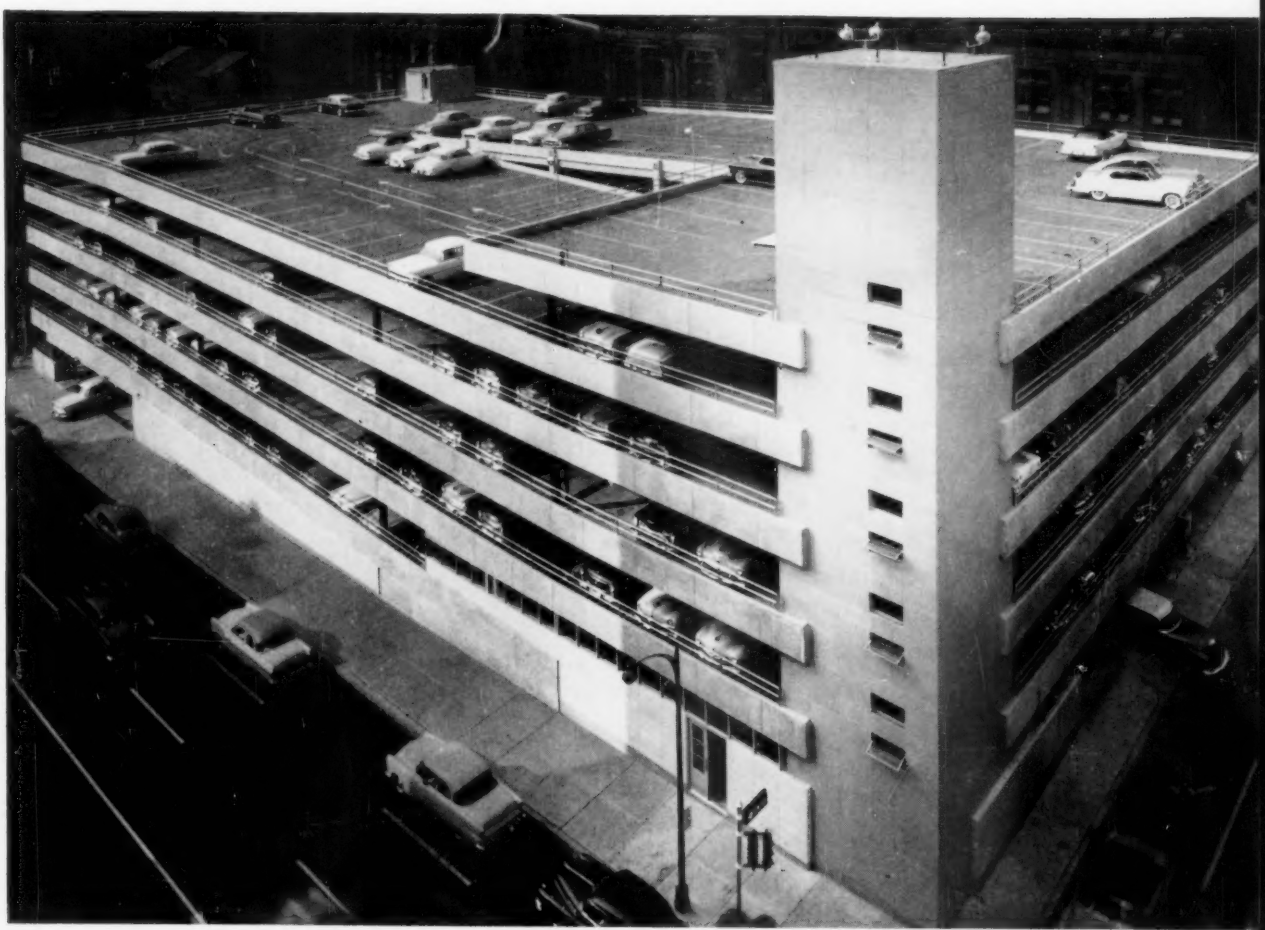

The completed six-level Allies Parking Garage. DESIGN—Hoffman and Crumpton, A.I.A., and Leland W. Cook, Structural Engineer. PLANNING CONSULTANT—Ramp Buildings Corporation. GENERAL CONTRACTOR—Ragnar Benson, Inc.

1. Structural Steel is the *strongest*, yet most economical of load bearing materials.
2. Structural Steel will withstand more abuse than other structural materials, effectively resisting torsion, tension, compression and shear.
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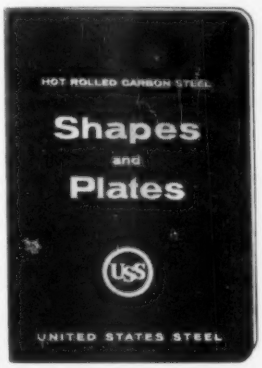


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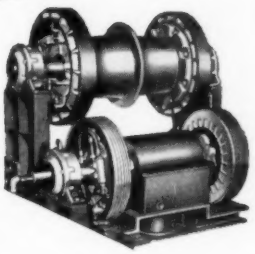
*and . . .* Five new *"QUICK-WAY"* Carriers

**THE MOST COMPLETE LINE IN THE SMALL SHOVEL FIELD**

# with MORE Big Shovel FEATURES



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**Power up and down boom standard on all models.**

High tensile steel shafting. Any one main assembly removable without tearing down others. Positive control shaft centers for 100% clutch and brake action.

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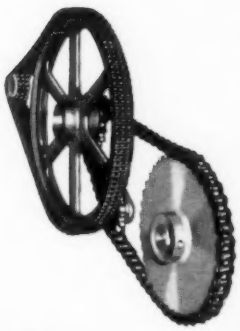
Large size, louver-ventilated, ductile iron clutch and brake drums, finned-ventilated swing assembly drums . . . specially designed for cool, continuous running at top efficiency.



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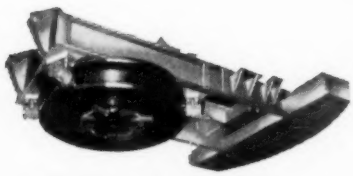
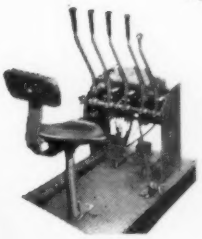
Machine-cut steel and cast iron sprockets with compact, high-speed, heavy-duty roller chains give positive power, reduced noise, and greater flexibility under every operating condition. Oil and dust tight cases.





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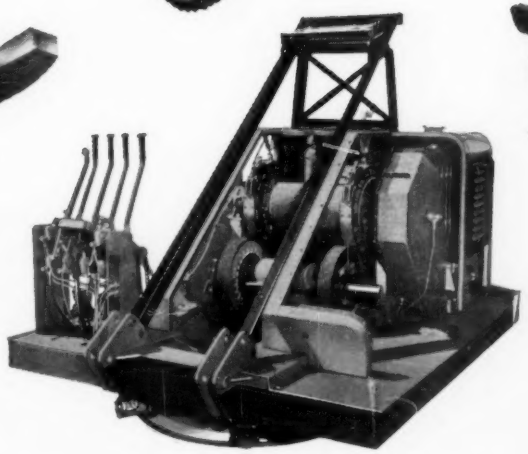

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Daily grease fittings centrally located on cab panel. Intermittent grease fittings easily accessible. Positive grease and dirt seals at all revolving points. Force-feed, filtered, circulating lubrication on all chain and sprocket drives and on main shaft bearings. Main bearings also running in oil.

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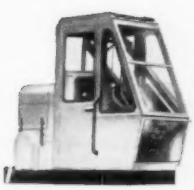
Self-aligning, anti-friction bearings on all high-speed, continuous, rotating shafts and drums. Special long-life, alloy bronze bearings on swing rollers and center rotating sleeve.



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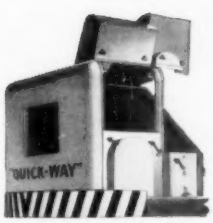
All operating controls, including instrument panel and lock throttle, conveniently located in front of operator. Safety glass windows on all sides and top insure full vision—sliding and hinged windows provide maximum ventilation.

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Hinged, fold-out panels all around for quick, easy maintenance and adjustments.

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. . . the new "QUICK-WAY" models, designed to heavy-duty specifications . . . with more big shovel features than any other in the small shovel field . . . have perfect BUILT-IN balance that guarantees precision control, greater lifting power, longer life and more work per horsepower. Write today for complete information, or see your "Quick-Way" distributor for a FREE demonstration.

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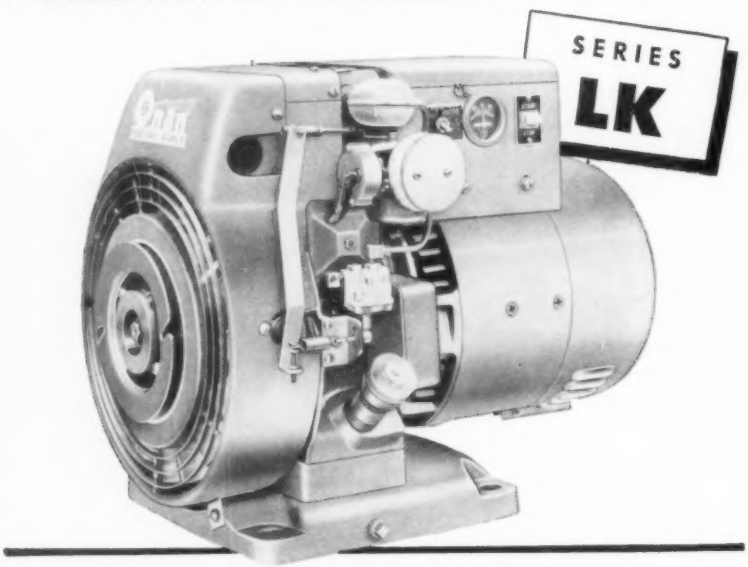
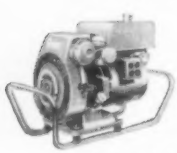
## New ONAN 2-KW Electric Plant




***Put it to work on your toughest jobs!***



**PORTABLE POWER**

*Stands up better under rough handling. Carrying -frame or 2-wheel dolly optional.*

**PRIMARY POWER**

*Runs longer in continuous day-after-day service. Dependable, economical.*

***A dependable source of electricity for emergency standby use***

*Built to do the job where other units won't stand up!* This new 2,000-watt, A.C., 115 or 230-volt, gasoline-driven Onan plant can take all kinds of punishment and come back for more. It's powered by a husky, Onan 4-cycle, single-cylinder, engine with Stellite-faced rotating exhaust valve, larger longer-wearing bearings, and efficient, trouble-free air-cooling. The Onan-built generator is direct-connected, permanently aligned, and fully-protected for use under all climatic conditions.

The Onan "LK" is compact too . . . requiring less than 3 square feet of floor space. Heavy-duty construction throughout . . . yet it weighs only 235 pounds. In carrying frame or dolly-mounted it can be taken anywhere and is easily moved around on the job.

The rating of 2,000 watts is conservative, allowing ample overload. Fuel consumption at full rated load is less than one quart of gasoline per kilowatt hour, making the "LK" a low-cost source of primary power. Recoil rope starter on models for portable use; electric starting available for stationary installations; automatic controls for emergency standby use.

**Wide range of accessories available**

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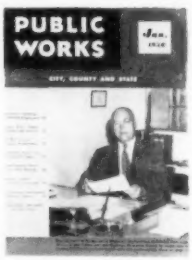


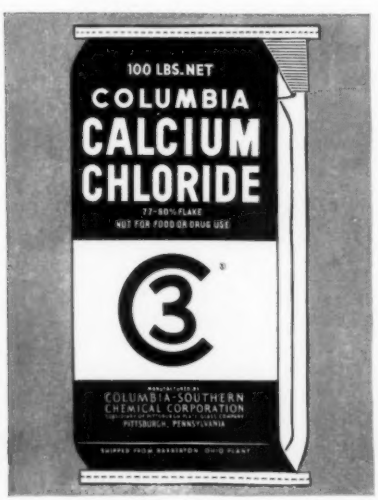

### LEADER IN PUBLIC WORKS

**Charles W. Cooke** is Director of Public Works for the City of Hartford, Conn. A graduate of Trinity College in 1914, with the degree of BS, he has been with Hartford since July 1, 1914. For the first three years he was chief of party and paving inspector; for the next 13 years he was assistant division engineer in the paving division; from 1930 to 1948, he was Division Engineer in charge of Planning. This work included a geodetic survey for the Metropolitan District and studies for the Regional Plan Commission. During this period he was also engaged on studies and plans for flood protection. He has been Director of Public Works since 1951, following three years of service as Assistant Director.

Mr. Cooke has been very active in engineering and civic affairs, in addition to his jobs for the City of Hartford. He is a member of ASCE, APWA, ARBA, ASPA, CSCE and CTC. He is First Vice-President of the Connecticut Society of Civil Engineers; past President of the Conn. Section, ASCE; President of the New England Chapter APWA; Director of the Municipal and Airport Division, ARBA; past President of the Hartford Lions; and President of the Board of Trustees of the South Park Methodist Church.

He is married and his hobbies, he tells us are photography and fishing.

# THIS WINTER...prevent accidents and costly traffic delays with 3-C COLUMBIA CALCIUM CHLORIDE




Slick, ice-covered roads are not only hazardous, they are robbers of motorists' time and money.

These roads when not properly treated cause motorists to be tardy for work which results in substantial losses in wages and production.

By treating cinder or sand stockpiles with 3-C Columbia Calcium Chloride, the abrasives are ready for quick, easy spreading at the first winter emergency. There are no frozen stockpiles.

Abrasives treated with 3-C imbed themselves in icy surfaces for better traction. Help prevent skidding. Abrasives do not blow away. Dangers are greatly reduced. Motorists are happy. Experiments show that calcium chloride treated abrasives stretch three times farther than untreated abrasives.

If desired, 3-C Columbia Calcium Chloride may also be applied directly to ice for quick melting.

Plan now to use 3-C Columbia Calcium Chloride. It's a wise program for preventing accidents this winter, and for saving valuable time and money. Order your 3-C supplies now through your nearest Columbia-Southern district office. Immediate delivery.

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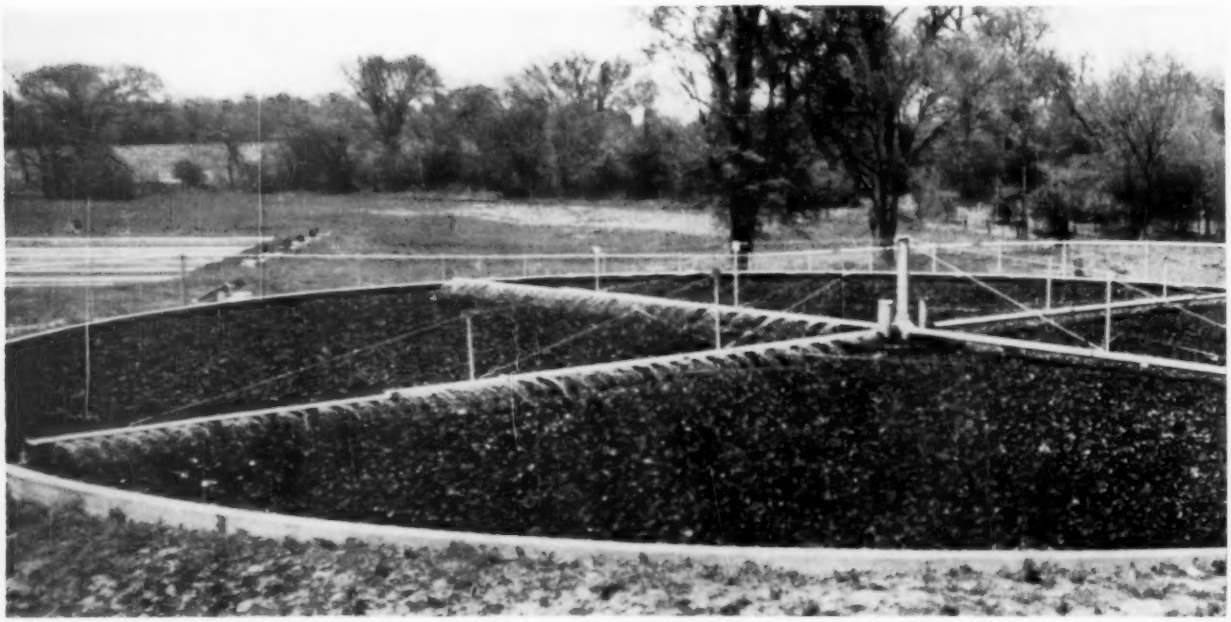

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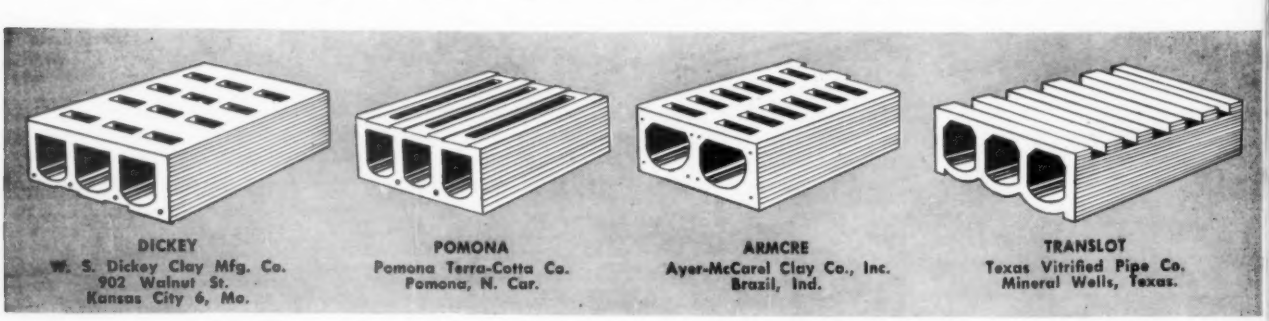

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Consulting Engineer: Charles A. Haskins, Kansas City, Mo. Contractor: Lippert Bros. Inc., Oklahoma City, Okla.

## Recommended underdrain specifications

*Underdrains.* — The Contractor will furnish and install underdrains which shall be laid in a dry mortar bed, on the floor of the filter before the stone is placed. Underdrains must comply with specifications ASTM C 159-51, and shall be equal and similar to those manufactured by members of the Trickling Filter Floor Institute. The mortar shall consist of sand and cement, 1 cement to 6 sand. After the underdrains are laid and before the stone is placed, the dry mortar shall be wetted by sprinkling. Blocks must be laid in true alinement, with cross joints staggered, in longitudinal rows at right angles to the center drains.

**Symbol of good treatment**

TFFI

## clay bottom blocks

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*Send for the Handbook of Trickling Filter Design—1954*

The best trickling filters use *vitrified clay filter bottom blocks.* We have issued an enlarged and revised edition of this popular handbook. If you don't have one write for your copy today without obligation. Just address any member of the institute and it will be sent free of charge.

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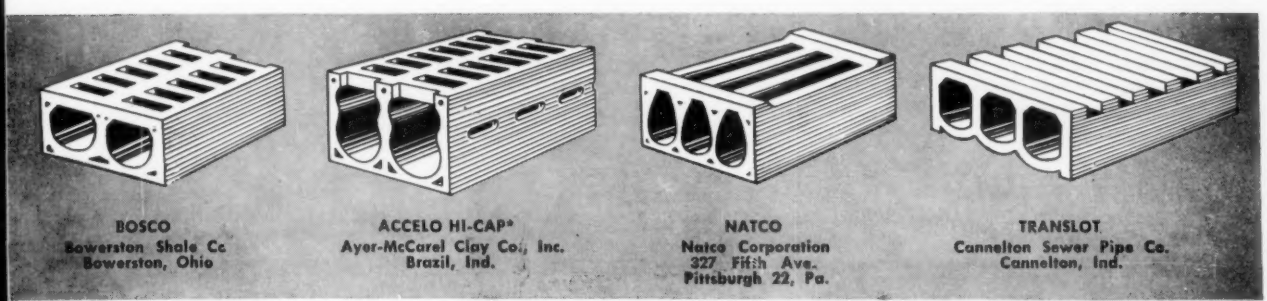

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# Dodson's Digest

## Don Watson's method of ice control is exposed

Don Watson dropped into my office the other day. It was snowing, and Don, a highway engineer, had promised to show me the operation of his snow-removal crew.

We got into his car and drove out to the highway. The moist snow was turning to ice on the road, and we watched as one of his trucks spread cinders on the ice, leaving a skid-proof surface behind it. Then we went to one of the stockpiles and watched a truck that was loading there.

"This is only the beginning," Don explained. "When the ice and snow melt, we'll send our bladers out to clear off the roads."

"You certainly are efficient," I complimented him. "And I'm glad to see that you use Calcium Chloride . . ."

"Wait a minute," Don broke in. "I never told you we use Calcium Chloride. How did you know?"

"It's obvious," I replied. "Your stockpiles aren't frozen. You must have used Calcium Chloride to keep the cinders free-flowing."

"Sounds logical," Don admitted.

"Also," I continued, "I noticed that the cinders were firmly embedded in the ice. Without Calcium Chloride, they would have been blown away, or swept off by passing cars.

"What's more, the ice and snow were beginning to melt on the highway. If you didn't use Calcium Chloride, that wouldn't happen at this temperature."

"Amazing, Dod," he grinned. "You missed your calling. You should have been a detective."

"Elementary, my dear Watson," I laughed. "I've been around Calcium Chloride long enough to recognize its fingerprints when I see them. Besides, you gave yourself away. You covered this stockpile with our green and red Calcium Chloride bags!"

— L. D. Dodson

P.S. — Our leaflet, "How To Make Icy Surfaces Safe With Wyandotte Calcium Chloride," is packed with information on ice control. Write me for your free copy today. *Wyandotte Chemicals Corp., Wyandotte, Mich. Offices in principal cities.*

Wyandotte CHEMICALS
HEADQUARTERS FOR CALCIUM CHLORIDE

# Washington news

Presented in cooperation with the American Public Works Association and through the courtesy of the Washington Office of the American Municipal Association

### *Federal Aid to Cities*

The regional offices of the Housing and Home Finance Agency are receiving increasing numbers of inquiries and applications from cities for assistance under the three expanded federal aid programs passed by the 84th Congress. Twelve applications, representing grants of $419,350, have been approved under the *Urban Planning Assistance Grant Program.* Grants have been made to seven state planning agencies for planning assistance to 76 cities. Grants have also been made to two state planning agencies for assistance to a regional and a metropolitan planning agency and to three metropolitan planning agencies directly. Twelve applications now pending would provide grants totaling $318,600 to state planning agencies for planning assistance to 33 cities. Of the $5 million originally authorized for the program for this year, Congress appropriated only $3 million. Grants are made to state agencies to provide overall community plans with the federal government providing up to 50 percent of the funds.

Twenty-one advances totaling $193,227 have been made to cities under the *Advances For Public Works Planning Program.* Over 1,000 inquiries have been received and 42 applications are in process for federal assistance in planning specific public works projects. Advances already made represent construction costs of nearly $27 million and include advances for 11 sewers, 4 schools, 3 water systems, 2 streets, and a civic auditorium. Planning advances are repayable without interest when construction is begun. Congress has appropriated $4.5 million which is available for this year.

Over 200 inquiries have been received for information on *Community Facility Loans.* No loans have been made at this writing under the new program. Application forms are being distributed to regional offices. The program, which became law with the signature of the President on August 11, authorizes loans to communities to finance necessary public works up to a total of $100 million of loans outstanding at any one time. Loans are available to communities which have been unable to obtain private public works financing at reasonable rates. Interest rates have been established at 3¾ per cent for 30-year general obligation bonds and 4¼ percent for 30-year revenue bonds.

Additional information and application forms are available at the nearest regional office of the HHFA.

### *AMA for Advance Commitment of Airport Funds*

Tentative allocation of federal aid airport funds to permit long-range planning of airport construction and improvement programs by sponsor cities is being urged by AMA in current sessions of the Airport Review Advisory Committee. The advisory group, appointed by the CAA last August, following enactment of the new four-year $251.5 million federal aid airport program by the 84th Congress is presently engaged in a study of application and grant agreement documents that will be used by CAA in processing the new program.

While the new 1955 amendment to the Airport Act authorized grant commitments for federal sharing funds at the rate of $42.5 million for the balance of fiscal year 1956 and $63 million per year for each of the following three fiscal years, it has been pointed out by CAA that grant offers can be made in a given fiscal year only to the total amount of the fund authorization for that fiscal year. Thus, if a sponsor city were to set up an over-all program for its airport for two or more years the CAA can obligate only that portion of sharing funds available for the first fiscal year. To the end that the intent of the 1955 act is to give sponsor cities an opportunity to develop long range plans, AMA is recommending that the sponsors be permitted to include the entire program in its project application and

# No. 4* of 12 REASONS WHY
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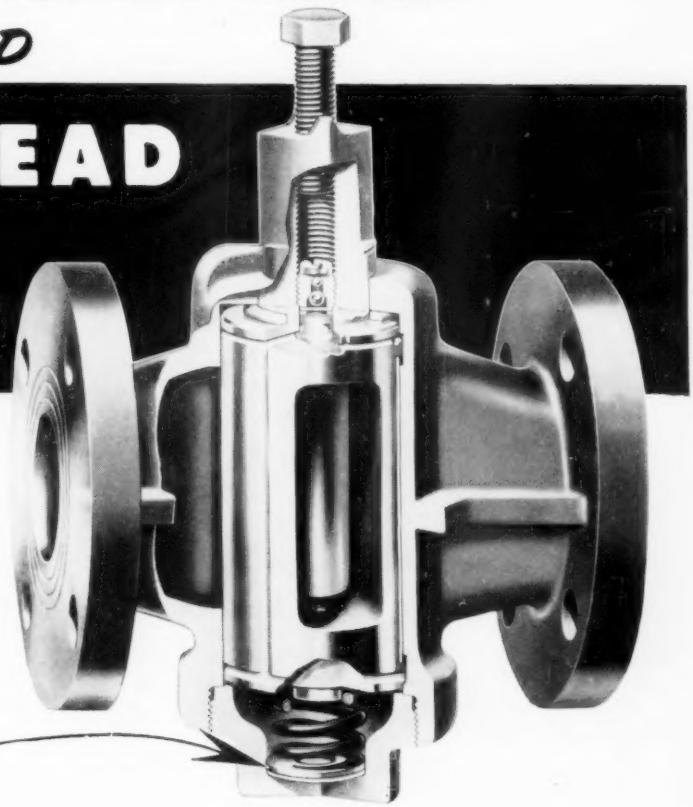

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Low friction Teflon washer permits spring to turn with plug. This means that less maintenance and longer life are assured, because the spring is subjected to compression only.

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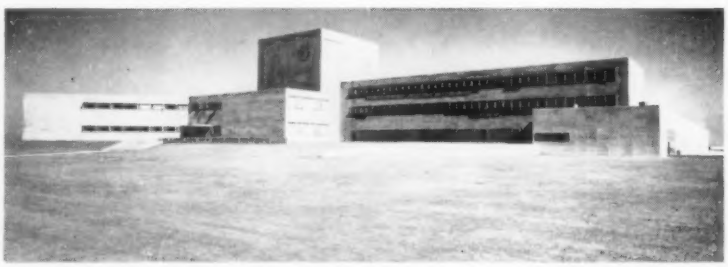

*The South District Filtration Plant of the city of Chicago, is the largest in the world. Northern Gravel Company furnished the 422 carloads with clocklike regularity, enabling installation continuously and economically*

## Filter Sand Specifications

are carefully laid out. The Effective Sizes and Uniformity Coefficients used by Consulting Engineers and also recommended by the American Water Works Association are the result of long years of research and experience.

The Northern Gravel Company is equipped to give you prompt shipment whether it be one bag or many carloads, exact to specifications. Filter sand can be furnished with any effective size between 0.35 MM and 1.20 MM.

## Chemical Quality

of the filter sand is also important. It must be hard, not smooth, and free of soluble particles. This requires perfect washing and grading facilities. We have every modern device for washing, drying, screening and testing.

## Filter Gravel

supporting the Filter Sand Bed must be, in turn, properly graded to sizes calculated to support the Filter Sand, and be relatively hard, round and resistant to solution.

Northern Gravel has no equal in facilities and our reserves of both sand and gravel are inexhaustible. Northern Gravel Company has been in business over 40 years. We guarantee uniformity of products and our records enable us to duplicate your requirements on short notice. Our location is central and we have commodity rates in every direction.

## Northern Gravel Company

**Muscatine, Iowa**

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that, if approved, the CAA's initial grant agreement will obligate the necessary sharing funds for the first fiscal year and at the same time make tentative allocations of funds for succeeding fiscal years. It is AMA's contention that this procedure will make it possible for cities to carry out successfully both engineering and financing plans for a long-range airport program with assurance of necessary federal aid to complete the project.

Herbert Howell, director of airports for CAA, reports widespread interest on the part of cities in the new aid program. Project applications are presently being processed by CAA regional offices. Announcement of project approvals and grant offers, covering the $42.5 million in sharing funds for the balance of fiscal year 1956, is now scheduled for January, 1956.

### *Domestic Point Four*

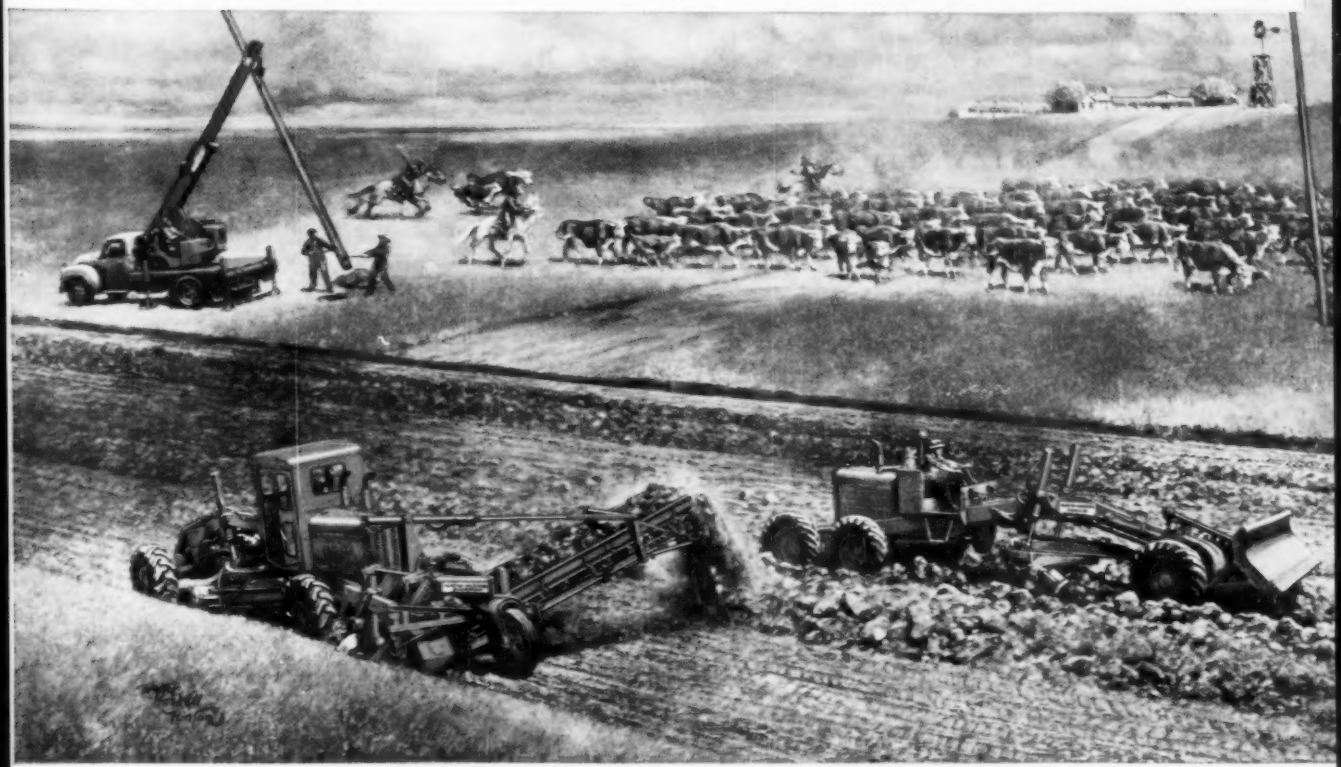
Chronically depressed communities may soon find relief if a plan presented to President Eisenhower by Dr. Arthur F. Burns, Chairman of the Council of Economic Advisers, is adopted. The plan, which has the "strong approval" of the President, contemplates the creation of a special federal agency to work with state and local authorities to reclaim industrial communities that have persistent unemployment. Legislation to effect the plan, to be introduced by the Administration in the next session of Congress, is expected to call for the authorization of government loans to stimulate industrial development in these communities. The special agency, located in the Department of Commerce, would coordinate federal, state, local and private aid to help communities to help themselves rebuild the economic base of the area. The Department of Labor, in its bimonthly summary of labor market developments, reports 23 major areas in 11 states as areas of "substantial labor surplus." Nearly 100 smaller depressed areas are also reported. They are located principally in the Pennsylvania, West Virginia and New England areas.

• • •

### Florida Operators' Group Wants Films, Slides, Models

The loan of films, slides or working models of pumps, treatment plant units; and other instructional material is desired by the Florida Water and Sewage Works Operators Association. W. S. Kelley, Box 1136, North Miami, Florida, Secretary of the Association, will appreciate suggestions for training material.

# Make Yours an Austin-Western in '56



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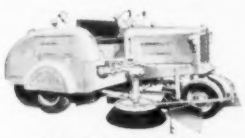
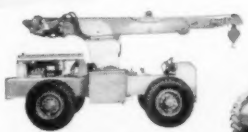


Model "40" Motor Sweeper

Tandem Roller



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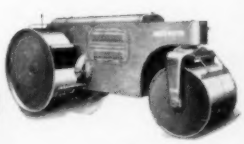

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Various types of Armco Pipe provide the material durability you need. Plain galvanized for normal service, asphalt coated for added protection, and for the most severe corrosion service you can get the protection of Armco ASBESTOS-BONDED. This has a layer of asbestos fibers embedded into the zinc coating and sealed with a special saturant.

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Kerrigan lighting standards are now found in cities all over the country—in parks and parking centers, on streets, highways and bridges—wherever there is a need for modern lighting. Made from J&L's low-alloy, corrosion resistant steel, Kerrigan Weldforged standards weather both the elements and the years. Write now for new catalog.

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## NEW LISTINGS

### Corrosion and Incrustation of Well Screens

**56.** Corrosion of well screens and the plugging of both the screen and the water-bearing formation by various incrusting materials are discussed fully in Bulletin No. 834 issued by Edward E. Johnson, Inc., 315 North Pierce St., St. Paul 4, Minn. Chemical treatment methods to remove incrustation are described. Check the coupon.

### Valuable Handbook on Sika Chemical Products

**83.** This handbook gives full information on admixtures for concrete, integrals for mortar, joint sealers, coatings, metallic compounds and quick-set compounds. Included are uses, advantages, addition, proportion, storage and prices. For your copy write Sika Chemical Corporation, 35-49 Gregory Avenue, Passaic, N. J., or check the coupon.

**MORE LISTINGS ON PAGES 34 TO 48**

### Bulletin on Remote Metering and Control

**92.** An 8-page color bulletin describing how chronoflow telemeters bring accurate records and control over an unlimited distance to the fingertips of plant operators is now available. Divided into 8 descriptive sections on various telemetering applications, the bulletin contains photos and installation drawings in addition to a description of the system's operation. Full details from Builders-Providence, Inc., Providence, R. I., or check the handy coupon.

### Cathodic Protection For the Treatment Plant

**130.** Why you should be interested in cathodic protection, what it will do for you and where it should be used are fully covered in literature just released by Electro Rust-Proofing Corp., Belleville 9, N.J. How it should be installed and how much it will cost are also fully described. Check the coupon.

**The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the coupon, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field.**

### Valuable Bulletin on the "Quick-Way" Shovel

**150.** Complete information on the "Quick-Way" shovel is available in bulletin from "Quick-Way" Truck Shovel Co., P.O. Box 1800 Denver, Colo. Described in detail are the anti-friction bearings, hook rollers, central lubrication system and the ease of operation, quietness and safety. Specific basic machine engineering data and ratings are also included. For your copy check the handy coupon.

### Catalog on the Flynn and Emrich Incinerator Stokers

**180.** This catalog describes the Flynn and Emrich incinerator stokers as to design, feeding capacities and loadings. Plenty of drawings of the stokers and photographs of incinerator plants under construction and in operation are included. Also, there is a good section on the incinerator history. Check the coupon today for catalog No. 1702 from Flynn and Emrich Co., Holliday and Saratoga Sts., Baltimore 2, Md.

### Calcium Chloride for Various Municipal Uses

**157.** A booklet on calcium chloride discussing its use in dust and ice control, dehumidification, refrigeration brine, concrete curing, dust-proofing coal and surface consolidation is available from Columbia-Southern Chemical Corporation, One Gateway Center, Pittsburgh 22, Pa. Photographs and tables are included. Check the handy coupon.

### Complete Catalog on Striping Machines and Equipment

**158.** The latest developments in striping machines and equipment for streets, highways, airports and industry are included in a comprehensive 32-page catalog just issued by Wald Industries, Inc., Huntingdon, Pa. Each striping machine is illustrated, has a complete, clear-cut description of features and specifications. Check the coupon today.

### Bulletin on Design Requirements for Clarifiers and Thickeners

**179.** Questions on design requirements of clarifiers and thickeners for a wide range of capacities and solids removal loads are informatively answered in this 16-page bulletin just published by Infilco Inc., Tucson, Ariz. Also, explained fully are why circular sedimentation basins, sludge scrapers and central inlet wells are features of these clarifiers and thickeners. Check the coupon today.

### Versatile Maintainer Has Year 'Round Usefulness

**195.** The Huber-Warco all purpose maintainer will work for you the year 'round on plowing snow, general sweeping and cleanup work, scalping berms and shoulders under guard railings, as a patch roller, berm leveler and highway mower. For full details on this piece of equipment write Huber-Warco Company, Marion, Ohio, or check the handy coupon.

### Information on Sewage Agitation in Sewage Plants

**201.** The Spencer centrifugal type turbo-compressor that is used in aeration operations in sewage plants is described fully in Bulletin No. 142-B. Operating costs, operation, advantages, maintenance and specifications are included. For more details write The Spencer Turbine Co., Hartford 6, Conn., or check the handy coupon.

### Water, Waste and Sewage Treatment Equipment Catalog

**253.** A complete catalog on water, waste and sewage treatment equipment is being offered by Walker Process, Aurora, Ill. Circular collectors, mixers, rotary aerators, thickeners, gas holders and floating covers are a few of the pieces of equipment covered. Check the coupon today.

### Remote Control Systems for Municipal Water Works

**279.** Complete information on remote control systems for the automatic operation of municipal water supply systems is available from Taller & Cooper, Inc., 75 Front Street, Brooklyn 1, N. Y. Bulletin 503 describes fully the local control of pumps, system operation, case history and other control equipment. Check the coupon today.

### Portable Hoist for Many Public Works Jobs

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1-56

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**New Products, pages 166 to 171:**

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Third 5D-190 In Service For Ohio Contractor

"The Huber-Warco 5D-190 allows us to make 15 more trips a day with our scrapers, than was formerly possible with other equipment," says Mr. Berlin Bruns, of Bruns Coal Company, a Zanesville, Ohio contractor.

This 5D-190, a 195 h.p. unit, is presently working on a four-mile stretch of new road on U. S. Route 50, southeast of Athens, Ohio. Approximately 287,000 yards of fill dirt is being moved to the job site, from a hill one and a half miles away.

The 5D-190 is constantly moving back and forth maintaining this one and a half mile stretch of road, keeping it clear for the four 20-yard scrapers, as they speed down from the top of the hill.

Mr. Bruns stated, "The 5D-190 works a 10 hour shift, six days a week, and has given us excellent service. Our operator reports, the perfect ballance of weight and power, plus the torque converter and power-shift transmission, handles a larger volume of work, with fewer passes, than he has experienced with any other grader previously used."

The Huber-Warco 5D-190 has many duties at the Athens job site, including grading of the fill, and towing a string of sheepsfoot rollers which compact the fill.

The Bruns Coal Company owns two other Huber-Warco 5D-190 motor graders. One is in operation at Steubenville, Ohio, and the other at Monterey, Tennessee.

In addition to the 195 h.p., torque converter, full power-shift transmission, and power-sliding moldboard, the 32,000 pound Huber-Warco 5D-190 also features: tail shaft governor, four wheel brakes, hydraulically cab-controlled blade movement, mechanical steering with hydraulic booster, high axle clearance, 360° blade rotation, and many other important features.

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*Road Machinery*

CABLE ADDRESS: HUBARCO

ROAD ROLLERS • MOTOR GRADERS • MAINTAINERS • GRINDERS

Now's the time to mail this month's Readers' Service Card.

To order these helpful booklets check the coupon on page 32.

## NEW LISTINGS (Cont.)

### Case Histories on Water Meter Installations

**283.** A factual report of the planning and operational procedures used by 11 water departments and companies in the installation of about 200,000 water meters is available from the Ford Meter Box Company, Inc., Wabash, Ind. Monthly meter rates, inspection report cards and various types of pack joint horns and setters are fully described. Check the coupon for your copy.

### Valuable Chlorinator Catalog

**300.** A chlorinator for purifying water supplies, treating sewage and industrial wastes and for control of slime is illustrated and described in Catalog 70-10 just released by Fischer & Porter Company, 539 Jacksonville Road, Hatboro, Pa. A multi-colored flow diagram showing how chlorine gas and water are kept separate until they reach the ejector system is included. For full details check the coupon.

### Booklets on Modern Street Lighting

**338.** Two booklets on mercury vapor lamps have been released by Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y. Included are the advantages of using mercury vapor and numerous photographs, showing typical applications. The various types of mercury vapor lamps are fully described along with their specifications. Check the coupon for your copies today.

### Data on "Cathodic Protection" for Corrosion Control

**381.** A 12-page illustrated technical bulletin, entitled "Cathodic Protection Systems" for corrosion control, describes the corrosive effect caused by the galvanic action of metals in contact with earth or water. Applications and case histories are fully described in bulletin by Harco Corporation, 16974 Broadway, Cleveland, Ohio. For full details check the coupon.

### Cure for Traffic Congestion

**238.** A prescription for curing traffic congestion by the use of rapid transit is given in the Bulletin No. GEA-6389, available from the General Electric Company, Schenectady 5, N. Y. This 2-color publication gives a complete discussion of how drivers can be converted into transit riders, what a transit system should consist of and why expressways alone won't solve the problem. For complete information check the coupon.

### Booklet Pictures Modern Trend in Outdoor Lighting

**264.** A new 16-page booklet titled "Outdoor Lighting with Plexiglas" offers help to the safety, highway, traffic or airport engineer seeking the most advanced methods of lighting large outdoor areas evenly. It describes and pictures the fluorescent luminaire and discusses the quality of light delivered and the maintenance, safety and appearance features. For full details write Rohm & Haas Company, Washington Square, Philadelphia 5, Pa., or check the handy coupon.

### Informative Data on Plating Waste Treatment

**394.** This reprint, entitled "Plating Waste Solutions—Recovery or Disposal," discusses the two possible methods of treating plating wastes by ion exchange or precipitation. Included are details of the costs involved, space requirements and illustrations showing typical plants and details of equipment. Available from Graver Water Conditioning Company, 216 West 14th Street, New York 11, N. Y., or by checking the handy coupon.

### What You Should Know About Venturi Tubes and Nozzles

**400.** A comprehensive bulletin, No. 100, of interest to all engineers dealing with the measurement of liquid flow and its various ramifications has been issued by Simplex Valve & Meter Company, Lancaster, Pa. Data on advantages, construction and installation details, range of sizes and specifications are given in simplified form. Check the coupon today for your copy.

### Information on Portable Concrete Testing Machines

**416.** A new bulletin on portable concrete testing machines, flexure attachments and accessories has just been released by Soiltest, Inc., 4711 West North Avenue, Chicago, Ill. Apparatus for preparation of concrete specimens for strength testing and for slump, yield and air entrainment testing and detailed illustrations of products and applications, technical descriptions and size and weight specifications are also shown. Check the coupon for your copy of Bulletin CT-711.

### Reliable Estimates of Smoke Density

**85.** The Smokescope, product of Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa., offers a reliable method for estimating smoke density. This data is the first requirement of an effective program for air pollution control. Find out how easy it is to take smoke density readings. Check the coupon for Smokescope data.

**For Prompt Service Use The Coupon**

### Auxiliary Electric Power For Public Utilities

**249.** Full descriptive information on Onan electric plants for every public utility need will be found in literature issued by D. W. Onan & Sons, Inc., Minneapolis 14, Minn. Be sure you have latest data on standby plants and controls for emergency electric power. Check the coupon now.

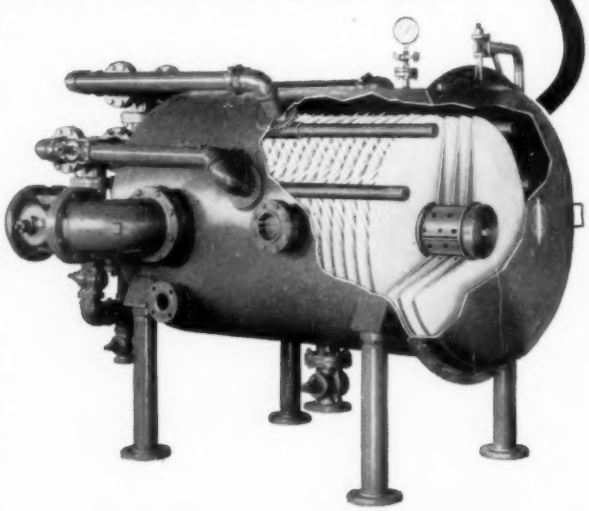
### Modern Methods and Materials For Joining Sewer Pipe

**402.** In a compilation of reprints and related supplementary material, the Atlas Mineral Products Co., Mertztown, Pa., presents a comprehensive review of all types of sewer jointing materials and methods. You will find this interesting and informative reading. Get a copy by checking the coupon.


*A new trend in municipal water filtration—*

**The SPARKLER DIATOMITE FILTER MODEL SCJ**

*has been highly successful in installations now in operation*



Reduced operating cost due to long filtering cycles and fast backwash cleaning, together with a remarkably low bacteria count requiring a minimum of chlorination, are features that make this new type filter worthy of the attention of all waterworks engineers.

With every backwash cleaning, the used filter cake is washed out with the residue, and a fresh pre-coat of diatomite applied to the filter plates, providing a completely new sanitary filtering media with each cleaning.

This filter removes all silica sand, algae, organic matter, silt, etc., from the raw water, and bacteria is reduced up to 80% and even more in some cases. The high quality of water obtained will raise the standard of water produced by some municipal water systems now using old methods of filtration.

Practically any volume of city water can be filtered economically in the Sparkler SCJ filter. Single units capable of handling 5,000,000 gallons of water a day are available. Multiple units can be engineered into a system for larger requirements.

Less than 0.2% of water is required to backwash and clean the largest filter units and a complete fresh precoat of diatomite can be applied and the filter ready to resume operation in 15 minutes.

Operators can be easily trained, no highly skilled specialized personnel is required to insure efficient performance.

Write for plans and prices on your requirements. Address Dan Baldwin for personal service.

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Home office and plant, Mundelein, Ill.

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Plants at Galt, Ontario, Canada — Amsterdam, Holland

Manufacturers of industrial filters for over a quarter of a century.

# Grotelite REFLECTIVE SHEETING

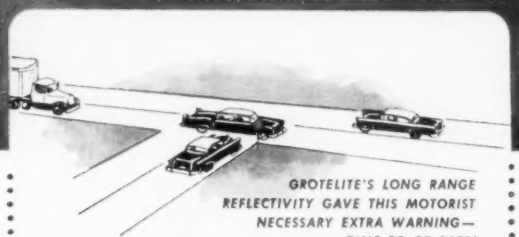
***gives the motorist time to be safe!***

STOP
AVERAGE STOPPING DISTANCE 132 FEET AT 40 M.P.H.
BRAKING DISTANCE
ALTHOUGH GROTELITE STILL CLEARLY LEGIBLE, IT'S TOO LATE TO HEED WARNING OF ANY TYPE IN THIS DANGER ZONE.
REACTION DISTANCE
GROTELITE SS CLEARLY LEGIBLE THROUGHOUT THIS DISTANCE!
GROTELITE SS VISIBLE HUNDREDS OF FEET BEFORE THIS POINT!

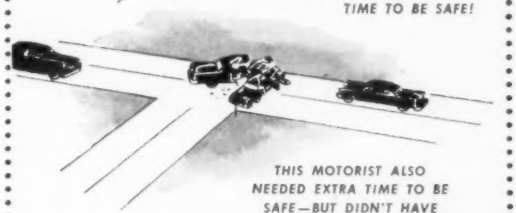
Too late to be warned, or *time* to be *safe* . . . Grotelite SS can make the difference! The traffic control sign reflectorized with Grotelite SS provides outstanding target value. It *alerts* and *warns* at the greatest distance from the point of danger. Through the blackest night, in any weather . . . Grotelite SS can be seen *farther*, seen *clearer*, seen *quicker* by the motorist!

### *Made For Maximum Warning!*

Grotelite SS is the *improved Smooth Surface* reflex reflective sheeting. Formulated from *acrylic* (methylmethacrylate) plastic, it has over 26,000 optical lenses per square inch. Strongly reflects light beams directly to their source. Only Grotelite SS offers such long range brightness and clearness.



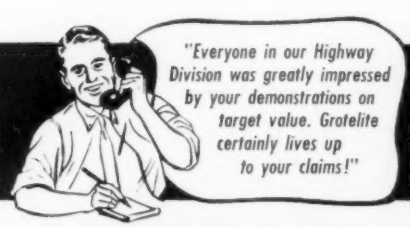
*GROTELITE'S LONG RANGE REFLECTIVITY GAVE THIS MOTORIST NECESSARY EXTRA WARNING— TIME TO BE SAFE!*



*THIS MOTORIST ALSO NEEDED EXTRA TIME TO BE SAFE—BUT DIDN'T HAVE GROTELITE'S MAXIMUM WARNING!*

**GROTELITE SS** is available in precut sheets for easy application. Also available on finished signs of all types. Four colors: yellow, red, green and silver (white).

Send *today* for Catalog No. 754-T . . . and for *complete facts!*


"Everyone in our Highway Division was greatly impressed by your demonstrations on target value. Grotelite certainly lives up to your claims!"

**THE GROTE MANUFACTURING COMPANY, INC.** • Established 1901 • Bellevue, Kentucky • Opposite Cincinnati

Get full details of this month's products . . . mail your Readers' Service card today.

### Tractors and Equipment for Municipal Use

**407.** Specifications for the John Deere "40" crawler and "40" utility wheel tractors, together with equipment for loading, dozing, mowing, sweeping and many other operations is covered in a comprehensive illustrated catalog issued by John Deere, Dept. 66B, Moline, Ill. Get your copy by checking the coupon.

### Expansion-Contraction Joints, Sealing Compounds and Waterstops

**272.** Helpful data to aid in the selection of premolded highway joint fillers and joint sealing compounds, rubber waterstops for concrete construction in water and sewage plants, sewer joint sealers and many related materials are provided in latest literature of Servicised Products Co., 6051 West 65th St., Chicago 38, Ill. Get ful details by using the coupon.

### Data Offered on Highway Drainage Products

**57.** Engineering data on corrugated metal culverts and pipe arch highway drainage structures are contained in bulletins of United Steel Fabricators, Wooster, Ohio. Just check the coupon—information on these fabricated steel products will be sent to you promptly.

### Diesel Power for Wheel Tractor-Loader Units

**151.** All the advantages and economies of diesel power are provided in tractor-loader units of Minneapolis-Moline, Minneapolis 1, Minn. Get latest information on wheel tractors and loaders by checking the coupon. It will help you select units to fit your needs.

### Handbook on Hot Rolled Carbon Shapes and Plates

**412.** A handbook every engineer should have on hot rolled carbon shapes and plates has just been released by United States Steel Corp., 525 William Penn Place, Room 5118, Pittsburgh 30, Pa. Check the handy coupon.

### Information on An "All-Purpose" Municipal Point

**423.** Whether the requirement be traffic paint, sewage plant, exterior finishes for masonry buildings, or interior protection for metal equipment send for literature just issued by Cellulose Products Dept., Hercules Powder Co., 978 Market St., Wilmington 99, Delaware on Parlon. This chlorinated rubber paint shows good resistance against coal gas, chemicals and chemical fumes and salt water atmosphere. Check the coupon today.

### Literature on H-Type Construction For Incinerators

**434.** This new H-construction developed especially for incinerator use features flexibility of design, lower costs through standardization, ease in speed of assembly and other advantages which are fully covered in literature from Laclede-Christy Co. Div., H. K. Porter Co., Inc., 2000 Hampton Ave., St. Louis 10, Mo. Check the coupon.

### Information on Trucks for Every Job

**442.** Literature on the world's most complete truck line is available from International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill. Included is information on basic models, conventional and COE, 4-wheel, 6-wheel and four-wheel-drive. Check the coupon.

## STREET LIGHTING AND TRAFFIC CONTROL

### Investigate These Street Lighting Standards

**54.** You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards, brackets and mast arms by using the handy coupon. Check these strong, well designed, inexpensive steel standards for practical street and highway lighting. Handsome 26-page folder includes data sheets on floodlighting and area lighting applications. Kerrigan Iron Works, 1033 Herman St., Nashville, Tenn.

### Convenient Data on Traffic Signs and Markers

**126.** A complete line of traffic control devices, including stop signs, warning, signs, regulatory signs and danger signals is presented in the fully-illustrated catalog of the Grote Mfg. Co., Bellevue, Ky. Helpful excerpts from the "Manual on Uniform Traffic Control Devices for Streets and Highways" are included. Get a copy by checking the coupon.

### Bringing Modern Street Lighting to Your Community

**141.** A 22-page catalog entitled "Light the Way for a Better Community" has just been issued by General Electric Co., Schenectady, N. Y. This catalog suggests how greatly your community will benefit from relighting and demonstrates the importance of a lighting survey and a carefully fully engineered planned-lighting proposal. For full details check the coupon.

### New Reflectorized Sign Faces Refurbish Old Traffic Signs

**292.** Get complete details on new "EZ-On" traffic signs faces ready for immediate shipments. Reflectorized faces cost only a fraction as much as new signs and are easily attached to existing traffic signs. Use the coupon for data today. Grace Sign & Mfg. Co., St. Louis 18, Mo.

## SNOW AND ICE CONTROL

### Reversible and Roll-Over Type Snow Plows for any Depth of Snow

**389.** Village, city, county, state and airport officials send for the latest information on Frink's two catalogues on reversible trip-blade and roll-over snow plows. Complete assembly details, specifications and operation are completely outlined. Write to Frink Sno-Plows, Inc., Clayton, Thousand Islands, New York, or check the handy coupon for the catalogues.


**Hoist**

**A HALF TON WITH THE POWER OF YOUR TRUCK BATTERY**

A valuable time saver around tire repair shops and garages.
Utility companies find many uses for Pacific Hoists.
Oil drums with barrel grab are easily loaded and unloaded.
Bottle grab is used in loading and unloading of carbonic tanks.

Pacific Portable Hoists cut receiving and delivery costs...pays for itself in a few months... consumes a minimum of current from regular truck battery. Low in price. Interchangeable from truck to dolly in moments.

*Write factory for illustrated literature and name of local dealer.*

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**HOIST DIVISION: 2944 S. E. Powell • Portland 2, Oregon**

**Find Pipes Faster!**

Use the new "Electronic Witch" M-SCOPE

Outperforms any pipe locator on the market regardless of price or design! Fully GUARANTEED:

- Built-in leak detector circuit in every instrument.
- Completely new electronic circuit—no wound antenna loops—no beat oscillator.
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- 50% less "B" battery consumption.
- Built-in Battery Checker available.

**Only $162.50**

with indestructible Fiberglas cabinets.

Send for FREE Manual "Special Pipe Finding and Leak Detecting Techniques".

FREE Instrument Catalog

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*Geophysical Instruments Since 1932*

# QUICK, LOW-COST ANSWER TO 4 PROBLEMS...

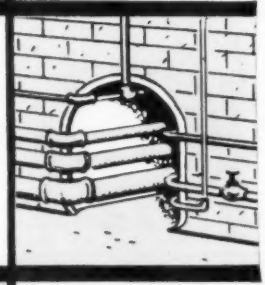
# Flat-Base Pipe

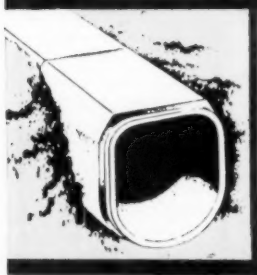
**PEDESTRIAN UNDERPASS**

The practical way to safeguard the lives of adults and children. Especially valuable near schools and playgrounds. Also helps to maintain an even flow of street-level traffic.

**UTILITY GALLERY**

Carries steam pipes, gas mains, electrical cables and telephone lines with ample room for workmen to make repairs. Flat-Base Pipe is also used for culverts and cattle passes.





**HEATED SIDEWALK**

When installed inverted, the flat-base part of the pipe becomes a sidewalk. Steam or hot water pipes running through the Flat-Base melt snow on the walk and provide better, safer footing.

**UTILITY MANHOLE**

Manholes for utility companies have often been built with Flat-Base Pipe in less than four hours. This eliminates needless traffic delay and reduces labor costs to a minimum.

Save as much as *30%* in the construction of pedestrian underpasses, culverts, utility galleries and manholes—with pre-cast Flat-Base Pipe. You can place and cover from 52 to 100 feet of Flat-Base Pipe in a single day. No forms to construct . . . no steel reinforcing to position . . . no concrete pouring. Can be jacked through old construction or laid in new fills. Joints are tongue and grooved and can be made watertight with rubber gaskets. Available now, in a wide variety of standard sizes.

*Our technical staff will be pleased to assist you with your pipe problems.*

**AMERICAN-MARIETTA COMPANY**
**CONCRETE PRODUCTS DIVISION**

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It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

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## WATER WORKS

### Engineering Information and Water Distribution Products

**49.** Helpful engineering information, covering water distribution problems, is available from Mueller Company in their W-96 Water Works Catalog. The 328 page catalog features a quick reference sectional indexing arrangement for easy location and identification of the hundreds of water distribution and service products illustrated. Check the coupon and you will receive detailed information on a complete line of water works equipment.

### Meter Features That Help Make Water Works Profitable

**59.** Simple design, accuracy and long life, moderate first cost and inexpensive maintenance are features of American water meters described in Bulletin No. 55 of the Buffalo Meter Co., 2917 Main St., Buffalo 14, N. Y. Be sure you have this informative booklet which gives the details of American meter design and construction plus full data on sizes, capacities and dimensions. Get your copy by checking the coupon.

### Efficient Coagulation With Ferri-Floc

**69.** Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal, control of certain tastes and odors, plus other aids in high quality water production. Check coupon for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

### 100 Page Book Helps Solve Water Problems

**71.** pH and Chlorine Control. A discussion of pH control and description of comparators, colorimeters and similar devices. A 100 page booklet. W. A. Taylor Co., 7304 York Road, Baltimore 4, Md.

### Do You Have An Independent Source of Electricity?

**27.** An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP-31 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 30 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the coupon.

### Data on Cutting-In Valves, Repair Sleeves and Accessories

**33.** A variety of Clow products for installation and repair of cast iron pipe lines, including the Eddy cutting-in valve and sleeve, split sleeves for pipe repair, test plugs, valve boxes, Strickler pipe cutters and other fittings and accessories are featured in literature available from James B. Clow & Sons, Inc., Box 6600-A, Chicago 80, Ill. Check the coupon.

### Motor Units for Valves Floorstands and Sluice Gates

**87.** Complete information on Chapman motor units is available in catalog No. 51 from The Chapman Valve Manufacturing Co., Indian Orchard, Mass. Advantages, installation and operation are fully described. For more details on these units check the coupon today.

### Rapid Sand and Pressure Filter Data

**109.** Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa.

### Specs for Gate Valves

**112.** Rigidly inspected gate valves for pressures up to 175 lbs. by R. D. Wood Co. Sizes 2" to 30"; for any standard type joint. R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.

### What You Should Know About Pipe Detectors

**94.** A new, up-to-date operating manual for pipe detecting instruments has been made available by the Computer-Measurement Corp., 5528 Vineland Ave., No. Hollywood, Calif. Although written chiefly for the Detectron Model 505, it contains operating hints and other information useful with any make pipe detector. To get a copy just check the coupon.

### Reference Catalog for Valves, Fittings and Hydrants

**125.** Complete data on gate valves for all services, operating accessories, check valves, fire hydrants and related specialties plus a reference section of useful engineering data is contained in Catalog H-1 issued by Rensselaer Valve Co., Troy, N. Y. All engineers who specify valves, fittings, and hydrants should have this valuable catalog for ready reference. Check the coupon.

### Engineering Data on Diatomite Filters

**139.** Get complete data on the Sparkler model SC-J diatomite slurry feed filter for swimming pools from the Sparkler Mfg. Co., Mundelein, Ill. Check the coupon for full information including table of filter sizes and capacities, space required and filter operation.

### Specifications for Infiltration Galleries

**159.** Infiltration galleries, constructed by the Ranney method, are described in an attractive bulletin issued by Ranney Method Water Supplies, Inc., 841 Alton Ave., Columbus 19, Ohio. This bulletin, plus complete standard specifications for the construction of horizontal infiltration galleries, are available by checking the coupon.

### Engineering Data On Mechanical Joint C.I. Pipe

**183.** General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking coupon.

CUT MAINTENANCE COST in HALF with GRACE "EZ-ON" TRAFFIC SIGN FACES:

'EZ-ON' Sign Faces—patented, are made of 30 ga. steel in 3 shapes and 3 sizes—octagon, diamond, rectangular—24" and 30" x 18" x 24". The former in red and yellow, the latter in white only. Standard copy or special—or the rectangular Face blank if you wish. They meet every need—at ½ the regular cost!

3 SHAPES . . . 3 SIZES!

'EZ-ON' Faces slip on right over your present signs—in less than 5 minutes—hence your signs are never out of service. Used by cities and Highway Dept's. all over the United States.

1. Slip 'EZ-ON' Face over old sign. Note wide flanges.
2. Then bend flanges backward holding 'EZ-ON' Face in place.
3. Use Crimping Tool to clamp flange and secure Sign Face.

GRACE 'EZ-ON' Sign Faces are reflectorized and meet all specifications for brilliance and reflective qualities. INVESTIGATE . . . and save. Their cost is HALF that of ordinary signs! SEND FOR SAMPLE SIGN.

GRACE SIGN & MFG. COMPANY
3605 S. SECOND ST. ST. LOUIS 18, MO.

It's True There are Other "Good" PIPE DETECTORS

and EACH ONE WILL PERFORM ALL THESE JOBS:

- Detect, trace and center pipes, cables, etc.
- Estimate their depth
- Separate parallel pipes, cables, etc.

Model 505 Pipe Detector

But... Do They Have ALL These "505" Features

1. ALUMINUM CASE shields the loops from outside interference and is light — durable — repairable.
2. BUILT-IN BATTERY TESTERS plus 67½ V batteries insure maximum service, more efficiency, more power.
3. QUICK-ACTION ALUMINUM HANDLE set up in seconds for one man operation.
4. LIFETIME GUARANTEE assuring reliable performance for the entire life of instrument.

Also Available: Model 505-C Combination Pipe-Leak Detector

*Get the complete "505" story — write Dept. 55.*

Detectron COMPUTER-MEASUREMENTS CORP.
Utilities Instrument Division
5457 Clean Avenue, North Hollywood, California


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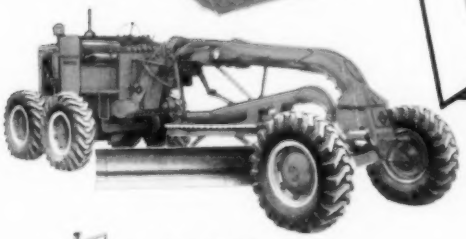


**ALLIS-CHALMERS CONSTRUCTION MACHINERY**

**SOLD** *but not forgotten*

**by your Allis-Chalmers dealer**

When you invest in Allis-Chalmers construction equipment, you are getting far more than just a modern machine. Your dealer offers you the opportunity to do a better job at lower cost. He wants your equipment to give A-1 performance day in and day out. His reputation depends on it.

That's why your Allis-Chalmers dealer puts so much importance on good preventive maintenance practices . . . encourages you to take full advantage of his modern servicing facilities.

**You're always sure of**

**TRUE ORIGINAL PARTS**

**from your Allis-Chalmers dealer**

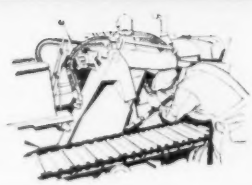
Parts made in the same factory, to the same rigid specifications as original equipment, are your assurance of getting top performance and long life. Treated, packaged and sealed against rust and dust, True Original Parts are stocked in quantity by each dealer to give you quick service close to your job.

**And you can have confidence in his**

**FACTORY-TRAINED MECHANICS, FACTORY-APPROVED METHODS**

**IN THE SHOP**

Specialized facilities include factory-approved tools and all necessary equipment for complete service. Factory-approved methods are used to save you time and money, assure finest workmanship.



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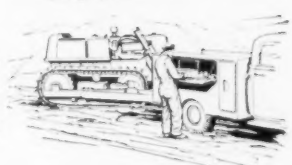
Factory-trained servicemen are ready to help you, day or night. Their technical know-how and practical experience get the job finished fast . . . at lowest possible cost to you.



***You can depend on your Allis-Chalmers dealer***

CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

**ALLIS-CHALMERS**

Thousands use our Readers' Service card to keep up to date . . . do you?

## To order these helpful booklets check the coupon on page 32.

### Lay Water Mains Faster Without Coupling Pullers

**184.** Get permanent water-tight joints automatically with Century "Fluid-Tite" couplings for Century asbestos-cement pressure pipe. Full details on this faster installation and self-energizing couplings are available from Keasbey & Mattison Co., Ambler, Penna. or by checking the coupon.

### Complete Catalog and Reference Data on Valves and Fittings

**211.** The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy. Get yours by checking the coupon.

### What You Should Know About Fluoridation

**217.** A helpful publication entitled "Fluoridation" which describes the development of fluoridation and lists the chemicals and dosages normally used has been prepared by Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J. Copies of publications on both solution and dry feed W&T Fluoridators are also available. These publications are yours for checking the coupon.

### Standard Specifications for C. I. Pipe and Fittings

**278.** Standard dimensions for cast iron water pipe and special castings are available in convenient booklets offered with the compliments of U. S. Pipe and Foundry Co. Birmingham 2, Ala. Get your copy by checking the coupon.

### Valuable Information On Prestressed Concrete Tanks

**356.** This helpful booklet describes the design, uses and advantages of prestressed concrete in all types of storage tanks. Plenty of charts, diagrams and illustrations are included. Get yours from Preload Enterprises, Inc., 21 East 37th St., New York 16, N. Y., or check the coupon.

### A New Pipe Finding Manual

**213.** A new manual of special pipe finding and leak detecting techniques of interest to utilities, municipalities, oil and gas companies is announced by Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif. The manual contains a number of articles on locating buried pipes and cables and detecting and locating fluid leaks in pipe lines. Check the coupon for your free copy.

### Manual Covers All Types Of Pipe and Service Repairs

**266.** Full details on the entire line of Skinner-Seal pipe repair clamps, service fittings and drilling equipment are presented in a new catalog and service manual offered by the M. B. Skinner Co., South Bend, Ind. Step-by-step installation pictures and captions give clear, concise instructions for the repair of all types of pipe leaks. Get helpful Catalog GW by checking the coupon.

### Points to Consider in Filter Sand Selection

**322.** Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa. Get full details by checking the coupon.

### Reference Data on the Electric Check Valve

**344.** Comprehensive data on the new Double Cushioned Electric Check Valve which simplifies backflow control at pumping installations is contained in an 8-page technical bulletin, issued by Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa. Details on valve design for quiet, positive operation, dimensions, wiring arrangements and head loss are included. Check the coupon for Bulletin W-10.

### Factors to Consider in Elevated Tank Selection

**299.** Details on the several different types of elevated steel tanks, including capacity ranges, tank dimensions and other factors to be considered in the selection of elevated tanks for modern water storage, plus discussions of new tanks for old towers and foundations are included in Bulletin 101 of the Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa. Check coupon for your copy.

### Engineering Data on Lubricated Plug Valves

**355.** Full information on Homestead lubricated plug valves in full-port and venturi types, sizes up to 14", and with a choice of self-sealed two-piece plug or one-piece plug designs. Engineering information includes principal dimensions, types of control, metals, lubricants, etc. For your copy write Homestead Valve Mfg. Co., Coraopolis, Pa., or check the coupon.

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### Diesel Engines For Municipal Power Needs

**359.** Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif. Get latest data by checking the coupon.

### Restoration and Protection Of Concrete Structures

**385.** A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication. Check the coupon for your copy.

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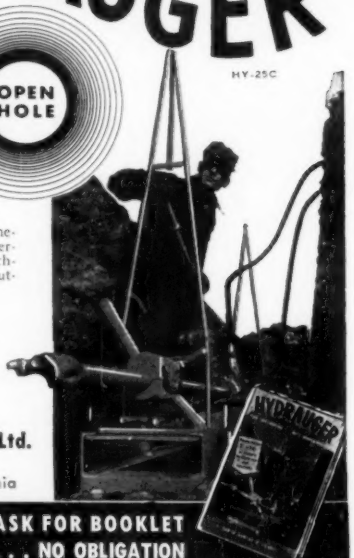


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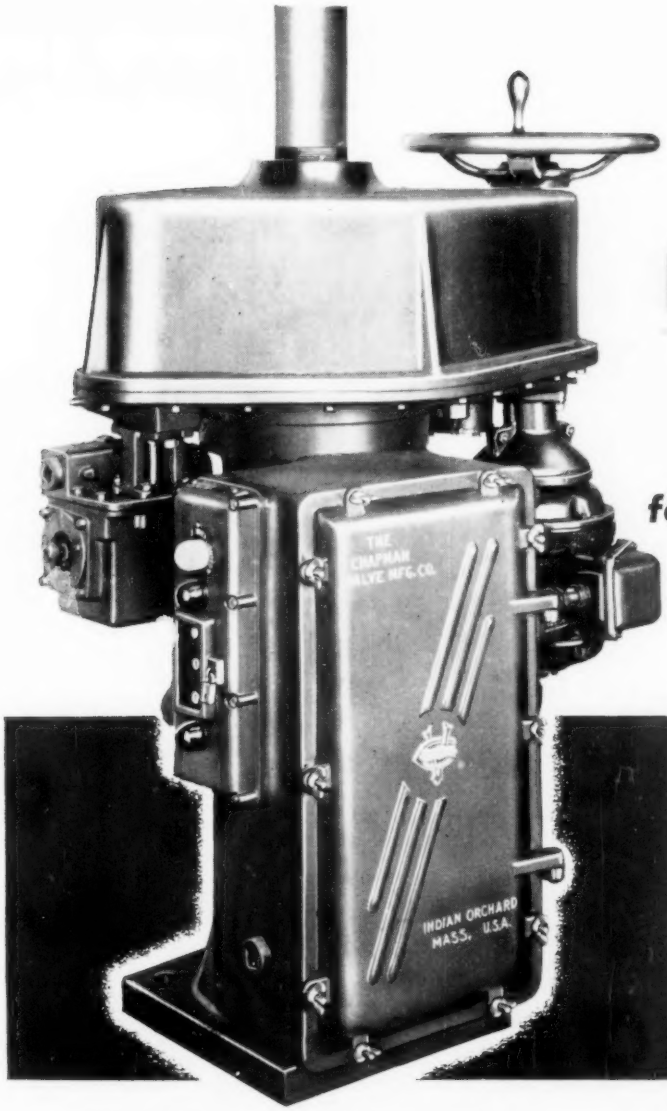


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### Helpful Engineering Data on Cast Iron Pipe

**422.** Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long. Check the coupon for your copy.

### Portable, Standby Or Continuous Power

**440.** Generators and power plants for emergency, portable continuous power are described fully in literature available from Katolight Corporation, Box 891-107, Mankato, Minnesota. Information on motor generator sets, high frequency changers and independent generators up to 400 K.W. is included. Check the handy coupon today.

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### For Fast, Smooth Pipe Cuts

**68.** Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, is available from Reed Mfg. Co., Erie, Pa. Check the coupon.

### Streamlined Data on Tractors, Scrapers and Power Units

**102.** The complete line of International Industrial Power products, 73 in all, is described in a new 48-page catalog just published by International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Technical data has been streamlined, yet provides abundant descriptive material on each piece of equipment. Check the coupon for the latest on crawler and wheel tractors, scrapers, dozers and related attachments plus International Diesel, gasoline and gas power units.

### How Accurate Boring Speeds Underground Pipe Installations

**135.** Interesting charts showing earth boring costs, speed and accuracy for holes from 2½" to 14½" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydrauger Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered.

### Valuable Booklet on Aluminum Pipe

**149.** Aluminum pipe for conveying everything from air to acid is thoroughly described in a new 18-page booklet published by the Aluminum Co. of America, 770 Alcoa Bldg., Pittsburgh 19, Pa. The two-color booklet presents the pipe's characteristics and advantages for each of its fields of application. Specifications are provided, along with a description of appropriate fittings and methods of installation. Check the coupon today.

### A Fully Rotary Compressor by Jaeger

**209.** Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air. For full details check the coupon.

### The Modern Approach to the Brush Problem

**222.** Eliminate your brush disposal problem by using an Asplundh Chipper. For complete information on what the Chipper can do, how it can save on costs, various types available and other outstanding features write to Asplundh Chipper Co., 505 York Road, Jenkintown, Pa., or check the coupon

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**247.** With a Trojan pipe pusher and puller no resetting of grip is required, so the work goes twice as fast. Two models, for pipe up to 2" dia. Get full details by checking the coupon. Trojan Mfg. Co., 1114 Race Dr., Troy, Ohio.

### Acker Drill Supplies Catalog

**290.** A 40-page catalog containing a very complete and up-to-date listing of all drilling tools and supplies used for soil sampling, foundation test boring, etc. is available from Acker Drill Co., Inc., Scranton, Penna. The catalog describes and illustrates the tools, accessories and supplies used by drillers everywhere. Check the coupon.

### How Motor Graders Beat the Snow Problem

**307.** The power and directional control of Austin-Western Four-Wheel Drive, Four-Wheel Steer Power Graders are a combination that beats the toughest plowing combination. Get data on plow and snow loader attachments for graders from Austin-Western Co., Aurora, Ill. Check the coupon.

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**376.** Substantial cost-per-hole savings are shown with Tilden Rotary Konkrete Kore Drills, which penetrate reinforced concrete up to 6" per minute. Standard drills available in sizes 3/16" to 6". Larger sizes on order. Free sharpening service continued. Full data from Tilden Tool Mfg. Company, 209 Los Molinos, San Clemente, California, or check the coupon.

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Frink One-Way Sno-Plows are available in 3 sizes and are interchangeable with the Frink V-Type, Reversible Type, or Roll-Over Type Sno-Plows and the Frink Roto-Broom.

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For further information on this Sno-Plow write for catalog to Clayton, N. Y., Box PW 561

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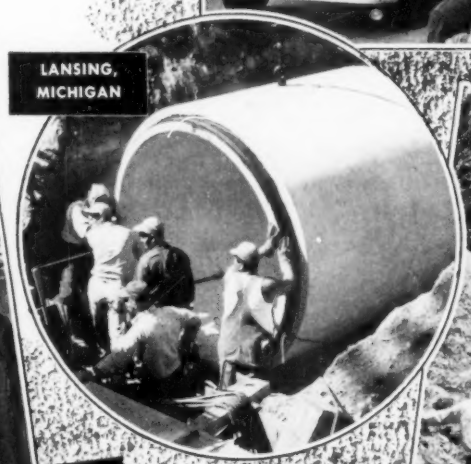


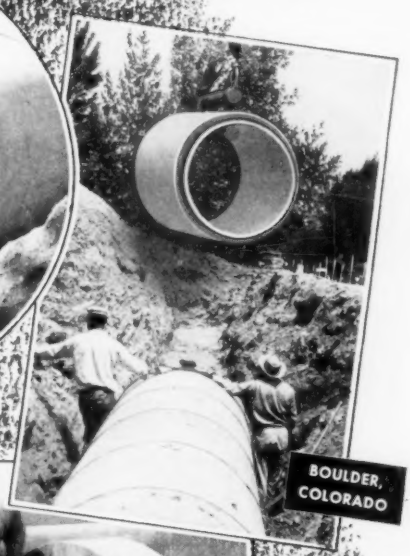


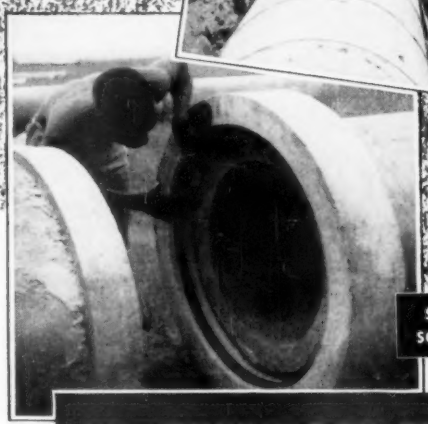


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### Self-Propelled Ditching Machines

**438.** Information on a self-propelled one man operated ditching machine, model 524 T, and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Full data on these ditchers available by checking the coupon.

### Power Shovel, Crane and Backhoe All in One Unit

**441.** A completely hydraulic backhoe, shovel loader and crane all in one unit is described in literature available from the Badger Machine Co., Winona, Minn. Also, information on front-end loaders, truck and trailer mounted hydraulic backhoes and various attachments that are useful for contractors, municipal and county engineers and state highway engineers. Check the coupon.

## RECREATION

### How to Equip Your Parks and Playgrounds

**414.** A handsome 60-page illustrated catalog showing a full line of extra heavy duty playground, pack-picnic and dressing room equipment, plus many related items, is now available from American Playground Device Co., Anderson, Ind. Complete specifications, construction features, prices and details of labor and materials needed for installation are included. Check the coupon today.

## STREETS AND HIGHWAYS

### Bitumuls Paving Handbook Full of Useful Data

**23.** The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproofing. You can have a copy by checking the coupon. American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 20, Calif.

### How to Select Prestressed Concrete Bridge Members

**26.** Colorful folder, well illustrated, shows manufacture of "Amdek" prestressed bridge members and provides selection tables covering several AASHO loadings. Full data from Concrete Products Div., American Marietta Co., 104 East Ontario St., Chicago 11, Ill. Check the coupon for your copy of this helpful reference bulletin.

### Levels Sidewalks and Curbs Quickly and Easily

**29.** How the Mud-Jack Method for raising concrete curb, gutter, walks and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the coupon.

### Makes Underground Pipe Installation Easy

**115.** One-man operated hydraulic pipe pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts ask for Form E-213, Greenlee Tool Co., Rockford, Ill. Just check the coupon.

### Do You Have Complete Black Top Equipment Data?

**41.** In 36-page catalog AA a full line of maintenance is covered. Units described and illustrated include several models of pressure distributors, supply tanks, sprayers, brooms, asphalt kettles, portable rollers, and accessory tools. Use coupon for copy of this handy manual. Littleford Bros., 452 E. Pearl St., Cincinnati 2, Ohio.

### How to Get Better Grader Operation

**111.** A most interesting and instructive 20-page illustrated action booklet on how to operate a motor grader is now available from Galion Iron Works & Mfg. Co., Galion, Ohio. Designed to help operators get more effective use from the versatile motor grader, this booklet covers the hydraulic system, steering, tips on leaning wheels, proper blade positioning, turning, gear speeds and operating procedures. Colorful, easy-to-read presentation guarantees good readership. Check the coupon for your copy.

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### Concrete Pavement Manual Offered

**171.** Details of design and principles of concrete pavement construction are presented in a 78-page manual published by the Portland Cement Assn., 33 W. Grand Ave., Chicago 10, Ill. Data from many sources is summarized in convenient form to help design and construction engineers. Check the coupon for your copy.

### Getting Specified Density In Granular Bases and Fills

**188.** Vibratory compactors offer the means for getting specified density in rock, slag, soil-bound macadam, gravel and sand base courses. Just one pass may suffice. Get complete information from Jackson Vibrators, Inc., Ludington, Mich. See how adaptable compactor units handle a variety of compaction needs. Check the coupon today.


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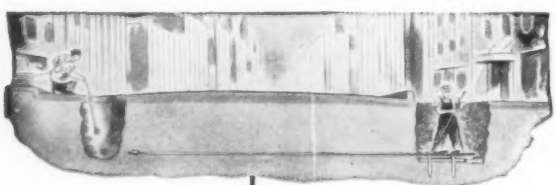
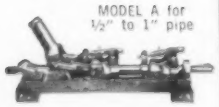
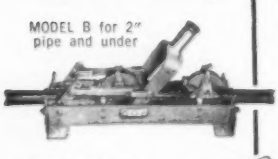
*in half the time* required by any other machine!





MODEL A for ½" to 1" pipe



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The Trojan combines pushing and pulling operations in one machine—keeps pipe continuously moving—lets you install 40' services in as little as 20 min.

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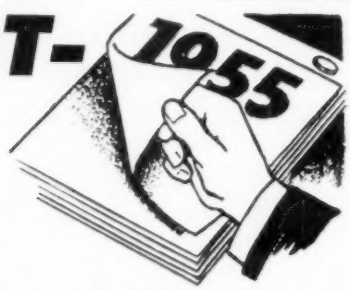

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### How the "Payloader" Helps Public Officials

**190.** An attractive new booklet "Getting More for the Tax Dollar with Payloaders" makes worthwhile reading for every public official in charge of construction and maintenance of roads, streets, and utilities. You will find illustrations and data showing dozens of ways the "Payloader" is used by cities, counties and states, plus convenient specifications on seven models. Check the coupon or write Frank G. Hough Co., 761 Seventh St., Libertyville, Ill.

### Choosing Trucks For Municipal Service

**204.** Trucks that are high in efficiency and economy are needed for all municipal services. Be sure to investigate latest models of White motor trucks, engineered for high performance under all conditions. Full details from White Motor Co., Cleveland 1, Ohio. Check the coupon today.

### How To Build Stabilized Heavy Traffic Pavements

**233.** A 16-page booklet published by Seaman Andwall Corp., Milwaukee, Wis., shows how low cost, local materials may be utilized in the construction of heavy duty pavements. Many illustrations and well-written text give full instructions on materials an construction methods for subgrades, subbases and base courses. A worth-while booklet for every highway engineer. Check coupon for copy.

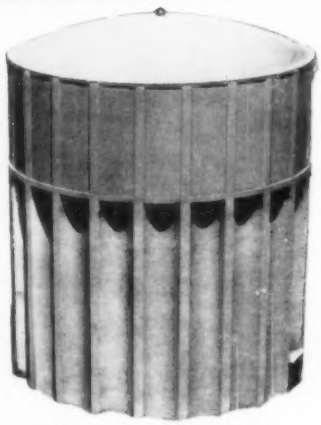
### A Roller Engineered for High Performance on Low Budgets

**254.** Bulletin S-68-555 on Buffalo-Springfield's standard tandem roller with torque converter drive has just been released. Describes the operation of the new drive with money-saving features that give low-cost rolling and high-speed operation. Send to Buffalo-Springfield Roller Company, Springfield, O., for your bulletin or check the handy coupon.


# THIS PRELOAD tank

## "Rides on Rubber"

To eliminate friction and to reduce restraint at the base of the tank wall which causes vertical bending moments, the wall rests on giant rubber pads. A rubber water stop passes between the footing and wall. These features lick the twin major problems of permitting the wall to move inward or outward due to prestressing and changes in water level and leakage at the base joint. Our Report 1-A gives interesting illustrated details on these features.



*2-million gallon prestressed concrete tank on 83' tower at Dulias.*

## ADVANTAGES TO YOU

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- Aesthetic possibilities unmatchable by any other materials for architectural treatment.
- A "PRELOAD job," whether done by us directly or through our local licensed contractors.

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PRELOAD

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### How to Solve the Brush Disposal Problem

**277.** Fitchburg Chippers, engineered to solve the brush disposal problem, reduce troublesome brush and trimmings to tiny, easy-to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16-page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass., or check the coupon for your copy

### The Dilemma of Our Present Highway System

**314.** "Where Do We Go From Here?" is the title of the new 16-page booklet produced by Caterpillar Tractor Company, Peoria, Illinois. Many highway problems are discussed in the interesting and informative booklet. Inadequate and obsolete highways, financing of free roads and toll roads, and whether to construct free roads or toll roads are a few of the topics. A section is devoted entirely to the story of modern highways from the planning stages through the construction stages to the finished roadways. Check the coupon for this booklet. Form 31398

### Trencher Fits Municipal Needs

**315.** A bulletin describing the Cleveland Model 95 trencher has been published by the Cleveland Trencher Co., Cleveland 17, Ohio. The Model 95, called "The standard machine for city and suburban work", is versatile, maneuverable and economical for use on water lines, service lines, road widening and all utilities trenching. Get this 8-page illustrated bulletin by checking the coupon.

### What Equipment is Needed By Modern Community Services?

**328.** The importance of modern equipment in work programs is graphically illustrated in the 16-page booklet "Allis-Chalmers Offers New Economy for Villages, Townships, Counties, Cities, States, Federal." Action photographs span the range of community projects and illustrate tractors, scrapers, graders, power units and their multi-purpose attachments. Get this handsome booklet and review your needs today. Allis-Chalmers Mfg. Co., Tractor Div., Milwaukee 1, Wis. Check the coupon.

### Use of Patch Material On All Maintenance Jobs

**297.** With the Barber-Greene Mixall you can get hot patch material wherever and whenever you need it for all maintenance jobs. Send for new 8-page bulletin that gives full information on this small, highly portable unit that turns out all types of bituminous patch material in any quantity you need. Write Barber-Greene Co., Aurora, Ill., or use the coupon.

### Tunnels Do It Better

**382.** Advantages of tunneling to avoid the interference of open trenching under highways, streets and railroads are discussed in a folder issued by Armco Drainage and Metal Products, Inc., Middletown, Ohio. Installation data and specifications on Armco Liner Plates for tunnels and conduits are included. Check the coupon for your copy.

### Advanced Tractor Design Gives Better Performance

**399.** For greater power, performance and economy, Ford Tractor offers 4-wheel stability, built-in hydraulic system and power take-off among the many new features. A complete booklet describes five models in two power series, showing the latest in advanced tractor design. For your copy check the coupon or write Tractor and Implement Division, Ford Motor Co., Birmingham, Mich.

### Effective Sweeping for Cleaner Streets

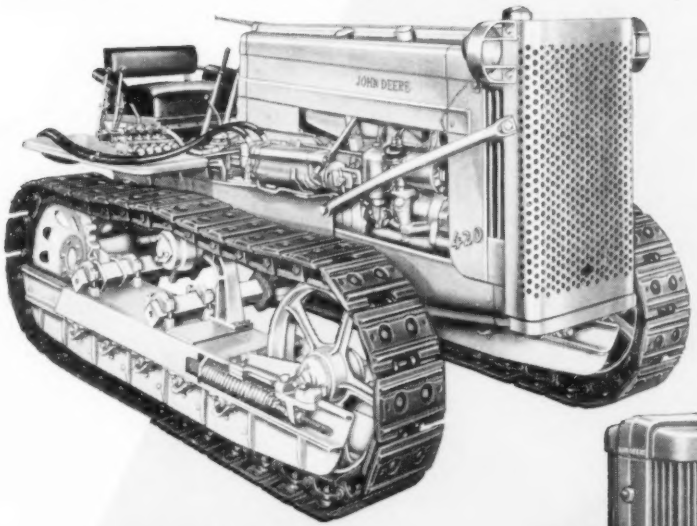
**421.** Outstanding features of Wayne Model 450 Sweepers are described in an attractive folder which covers operating advantages and general specifications. Data on dual control models are included. For your copy write Wayne Mfg. Co., Pomona, Calif., or check the coupon.

### Valuable Information On Aerial Surveys

**437.** What you should know about aerial surveys is described in detail in the latest literature just released by Alster and Associates, 6135 Kansas Ave., Northeast, Washington 11, D. C. Topographic maps, mosaics and planimetric maps by aerial photograph are fully illustrated. For more information check the handy coupon.

# EVERYTHING YOU WANT

## in "Handyman" POWER and Equipment



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**Weighs slightly over 4000 pounds . . . develops 25 horsepower on the drawbar. 4- and 5-roller sizes. A "little giant" in its work capacity. Choice of track shoes.**

**JOHN DEERE UTILITY**

**The "handyman" wheel-type tractor of a hundred-and-one uses. Low-built. Highly maneuverable. 3-point hitch regular.**

EVERYWHERE . . . on many types of work . . . the John Deere Crawler and the John Deere Utility are making good in a BIG way with profit-minded contractors and industrial users.

Both models are built around the highly efficient, economical, and dependable John Deere engine. (The word economy is not used loosely. Owners' reports average only *one gallon of gas per hour* on all types of work!)

Here is the compact, rugged construction that has characterized John Deere-built products for nearly 120 years.

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And here is the simplicity and accessibility you want for ease of servicing which spells LOW-COST MAINTENANCE throughout the long productive life of a John Deere Tractor.

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**Industrial TRACTORS and Equipment**

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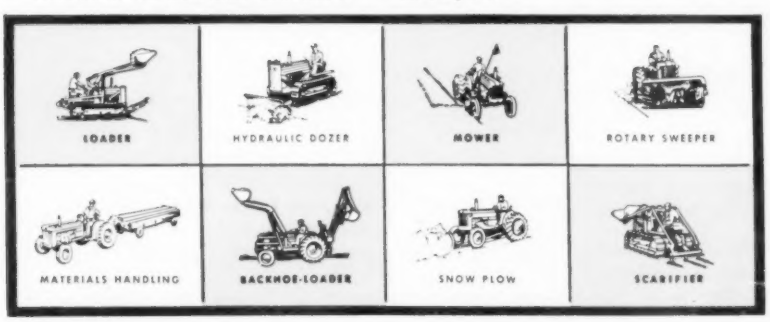


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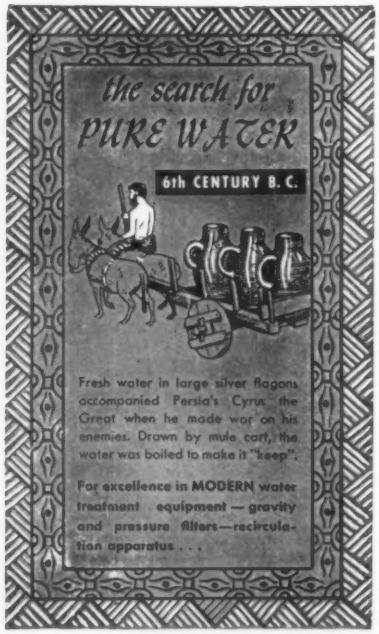
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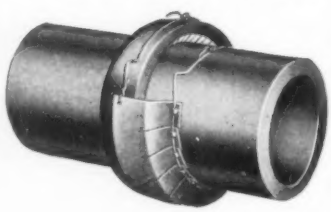
**BUILD BETTER SEWER LINES**



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- No jute used—gasket centers spigot.
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## SEWERAGE AND WASTE TREATMENT

### What You Should Know About Trickling Filter Underdrains

**20.** Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the coupon and we will forward your request.

### How to Make Better Sewer Pipe Joints

**37.** How to make a better sewer pipe joint of cement–tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass.

### A Handbook of Sewer Cleaning Methods and Materials

**44.** Complete, easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible, Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included. Check the coupon for your copy of this helpful handbook.

### Engineering Data on Screening Equipment

**77.** Water, Sewage and industrial waste screening equipment is fully described in a 28-page book, No. 2587, offered by Link-Belt Co., Dept. 137, Colmar, Pa. Complete data for the engineer and tables to determine the proper size unit for handling various capacities are included. This valuable, comprehensive booklet may be obtained by checking the coupon.

### Theory and Application Of the Flow Tube

**84.** Hydraulic formulae, head capacity curves and test data for this primary metering element are given in a technical bulletin, "Theory and Application of the Flow Tube," available from Foster Engineering Co., Union, N. J. Check the coupon for a copy.

### Theory of Controlled Digestion With Floating Cover Tanks

**88.** In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers. Requests for this valuable booklet must be made on business letterhead.

### Proper Installation of Bituminized Fibre Sewer Pipe

**105.** A well-planned instruction leaflet showing the proper step-by-step procedure for installation of Bermico bituminized fibre sewer pipe has been made available by Brown Co., 150 Causeway St., Boston 14, Mass. To make sure of best results in pipe installation, just check the coupon for your copy.

### Comminutors for Automatic Disposal of Coarse Sewage Solids

**152.** The problems connected with disposal of coarse sewage solids are eliminated by clean, odorless, automatic Comminutors. Full engineering data show the proper model for every size plant and furnish details of hydraulics and typical installations. Chicago Pump Co., Dept. J, 622 Diversey Pkwy., Chicago 14, Ill.

### Efficient Underdrains for Rapid Sand Filters

**239.** Be sure you have engineering data on vitrified clay underdrains, efficiently designed for filtering and backwashing. Check the coupon or write F. B. Leopold Co., Inc., Dept. PW, 2413 W. Carlson St., Pittsburgh 4, Pa.

### Catalog on Sewage Gas Meters, Regulators and Valves

**245.** A handy catalog on sewage gas meters, regulators and valves is available from Rockwell Mfg. Co., Pittsburgh 8, Pa., also included are data on lubricants and accessories, power and remote operation, semi-steel valves and multiport valves. Check the coupon.

### Complete Booklet on Pipe Line Equipment

**246.** Equipment for all types of jointing, maintenance and repair jobs on water, gas and sewer lines is described and illustrated in Catalog No. 25 issued by Joseph G. Pollard Co., New Hyde Park, N. Y. Leak detectors, pipe finders, melting kettles, cleaning tools and a full line of hand tools for water and sewer departments, and many other items are included. Be sure to get your copy now. Just check the coupon.

### Complete Story of Rubber as a Coupling Medium in Pipelines

**295.** "Joint Enterprise", a booklet describing Tylox rubber joints for coupling pipe used in sewerage, drainage and waterworks projects is now available from Hamilton Kent Manufacturing Co., 427 West Grant St., Kent, Ohio. The booklet also contains illustrated case histories of Tylox-Jointed installations, and suggestions to assist engineers in specifying Tylox joints for both tongue and groove, and bell and spigot pipe. Check the coupon.

### Flexible Coupling Speeds Vitrified Pipe Installation

**311.** Fast pipe laying with chemically inert, leakproof joints is made easy by Universal vitrified pipe with Tylox rubber joints. Full information on these materials and pipe laying methods is available from Universal Sewer Pipe Corp., 1500 Union Commerce Bldg., Cleveland 14, Ohio.

### Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

**425.** Latest information on the Komline-Sanderson "Coilfilter", which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 102 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the coupon today.

### Solids Pump Uses Recessed Impeller

**428.** The Wemco "Torque-Flow" solids pump works with a completely recessed impeller which creates a vortex effect and transmits power exactly as in a fluid type torque converter. This avoids flow through impeller vanes and reduces clogging difficulties when handling sewage sludge or abrasive materials. For full details, get Bulletin SP-10 by writing Western Machinery Co., 760 Folsom St., San Francisco, Calif., or check the coupon.

## REFUSE COLLECTION AND DISPOSAL

### New Development in Refuse Collection

**119.** The newly introduced "Dempster-Dumpmaster" system for refuse collection combines the advantages of detachable containers for bulk collection, convenient front-end loading and compaction in a sealed body. Be sure to investigate the application of this system to your collection needs. Complete data offered by Dempster Bros., Knoxville 7, Tenn. Check the coupon today.

### New M-B Packer Body Designed for Maximum Payload

**309.** The M-B Packer Body, designed to provide maximum payload on a minimum size, low-cost truck, features effective, simple compaction system; provides easy loading, positive discharge, al safety features. Available in 12-14-16 yd. capacities. Get all the facts from M-B Corporation, New Holstein, Wis. by checking the coupon.

# don't buy "blind"... COMPARE!

## 1 more blocks of collection each day!

You make more collection stops . . . cover more blocks . . . increase route lengths . . . with fewer collection vehicles when M-B Packers are on the job. Loads faster too . . . large convenient side doors . . . fewer packing cycles . . . speeds the entire collection process. Powerful progressive compaction means more pounds per load . . . fewer dead run trips to the dump and back.

## 2 lower cost per ton hauled!

Costs less to buy, operate and maintain. Requires lighter truck chassis than comparable size complicated hydraulic packers. Fewer packing cycles and fewer dead run trips back and forth to dump save fuel, time, wear and tear. Simple winch operated packing plate does away with yards of tubing, expensive fittings, pumps and leaking hydraulic lines. M-B Packers do the job at lowest cost per ton.

## 3 packs anything — no "call backs"!

Anything and everything goes into an M-B Packer — large cardboard boxes, wet garbage, wooden crates, drums, springy tires, powdery ashes, leaves, brush — there's no selective loading or pre-crushing. Those occasional items too large for the extra-wide side loading doors can be carried on the flat reinforced roof.

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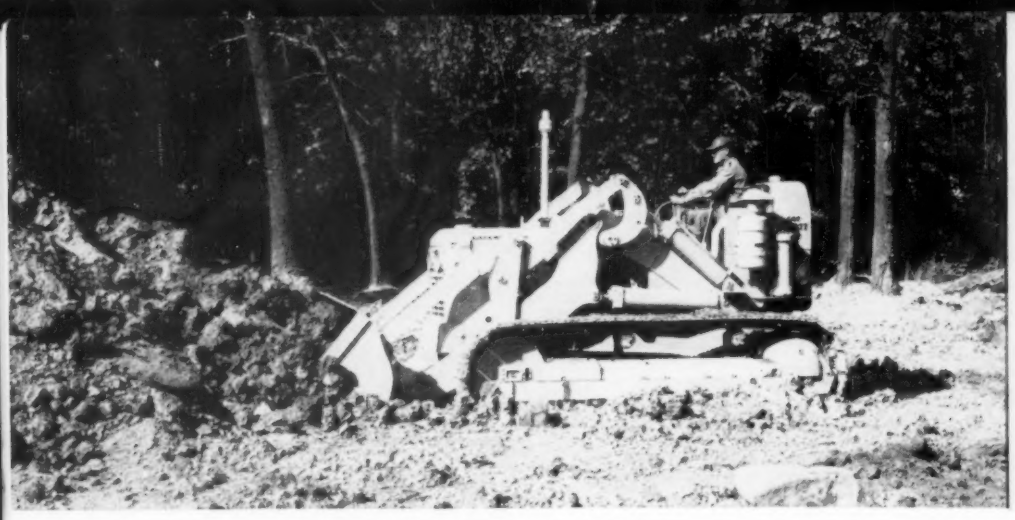


**1**

**Ample power and traction to "bury" the bucket.**

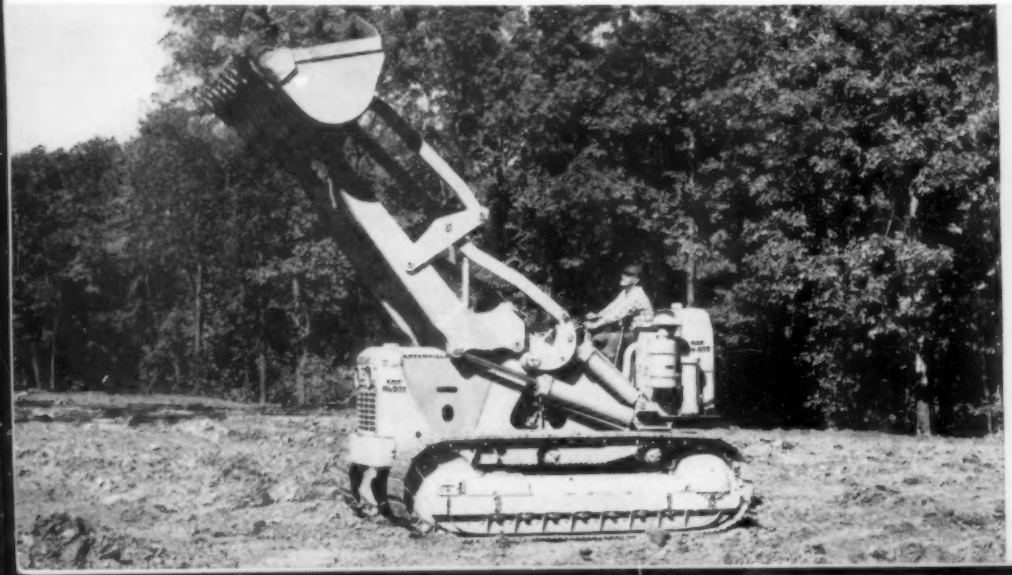
## CATERPILLAR ANNOUNCES

# THE NEW NO. 977

Here's the new boss of the excavator-loaders...the new Caterpillar No. 977 Traxcavator. The No. 977 has important new features which greatly increase productivity and earning power.

### FEATURES OF THE NO. 977 TRAXCAVATOR

- 96-in., 2¼-cu.-yd. bucket.
- 100 HP CAT® Engine, with ample power to "bury" the bucket and lift big loads.
- Newly-designed bucket tips back 40° at ground level to retain heaping loads.
- More than 11½ ft. of dumping height make it easy to load any truck or railroad car.
- Steel bumpers on lift arms allow rapid jarring of bucket, and 50° discharge angle helps to empty sticky materials fast.
- Automatic kick-outs put bucket in "hold" position at maximum height and position bucket for digging on next pass. Easier operation and faster cycle times.
- Advanced hydraulic system, with pump protected by full flow filter.
- Hardened, spool-type operating valves located in large tank, protected from dirt or damage.
- Long-lived, trouble-free oil clutch.
- Fast, one-hand bucket operation. High seat for comfort and visibility.
- Five forward speeds to 7.4 MPH; four reverse speeds to 7 MPH.
- Each track controlled by heavy-duty dry multiple disc steering clutch and contracting band brake.
- Tools for any job: 3-yd. bucket for light material; 9-tooth quarry bucket; heavy-duty bucket; skeleton rock bucket; log and lumber fork.



**3**

**High lift, with over 11½ ft. of dumping height.**

**2**

**40° tip back at ground level to hold load.**

# TRAXCAVATOR*

**MAIL TODAY!**

**CATERPILLAR TRACTOR CO., Peoria, Illinois, U.S.A.**

Please send full information about the new No. 977 Traxcavator.

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Company_____

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Now three sizes of Traxcavators are available for all your excavating and material-handling needs. They're *unit-built* machines, so efficient that you'll find they match or excel competitive equipment with nominally greater bucket sizes. You can choose the right Traxcavator for your job from the No. 933 (1 cu. yd.)—the No. 955 (1½ cu. yd.)—or the No. 977 (2¼ cu. yd.).

Let your Caterpillar Dealer show you how these new machines can make money and *save* money for you. Get complete information from him. Or mail the coupon.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

**CATERPILLAR***

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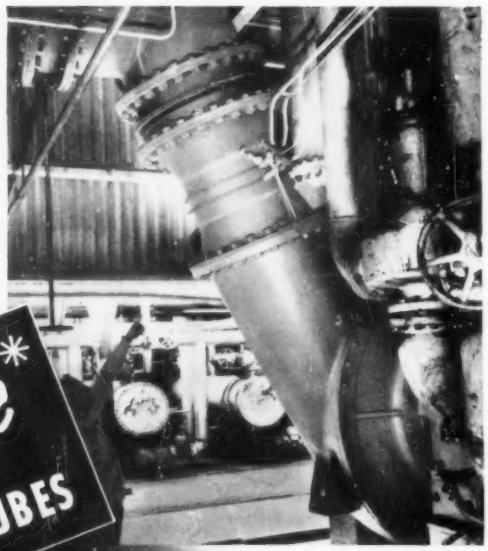
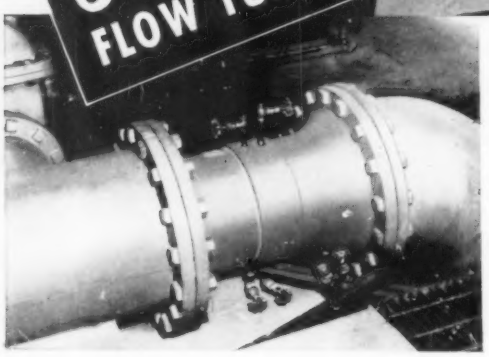
**4**

**Fast, sure dumping of sticky materials.**

# PIPING LAYOUT IS SIMPLER with Gentile* FLOW TUBES





...THEY NEED SO LITTLE ROOM

Gentile Flow Tubes are short. They need only minimum straight runs entering and following, and can be installed at practically any accessible point where flow conditions are reasonably steady.

Flow Tubes are furnished with individual head capacity curves, and for unusual piping arrangements, calibration curves for simulated conditions can be furnished.

*Guaranteed*

- Accuracy
- Minimum Head Loss
- Reproducibility

*GEN-TIL-LY

**FOSTER ENGINEERING COMPANY**

835 LEHIGH AVENUE UNION, N. J.

AUTOMATIC VALVES • CONTROL VALVES • SAFETY VALVES • FLOW TUBES

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## SEWER INFILTRATION

We are finding it extremely difficult to obtain a uniform and adequate test of newly laid sewer lines for infiltration. This is particularly true where sewer lines are being constructed in new subdivisions prior to the installation of the water system. When construction is during dry weather the ground is relatively dry and of course, there is no infiltration. In areas where water is available we have adopted the practice of running infiltration tests immediately after the puddling of the trench. When water is not available for puddling, we have of necessity waited for the first rain before running an infiltration test.

The above procedure is definitely haphazard and gives an unreliable test value because of the different conditions that will exist as to water adjacent to the pipe.

We have heard of the possibility of using an exfiltration test which would require a relatively small amount of water. However, we have not been able to obtain any information as to how an exfiltration test would be conducted or its correlation with the infiltration test. Of course, pipe on fairly steep grade would have a wide range of hydrostatic head and in some cases water would be flowing from the top of the lower manhole before the upper section of pipe was filled.

We would appreciate your advice as to any source of information concerning the exfiltration tests as well as a more uniform pressure for conducting infiltration tests.

*George R. Talcott*
R. Stuart Royer & Associates
15 West Cary St.,
Richmond, Virginia

Editor's Note: An article on exfiltration testing, PUBLIC WORKS, Aug., 1946, has been sent to Mr. Talcott. He will appreciate additional data. Please send a copy to the Editor.

# General Electric Fluorescent Street Lighting

## Designed for the Community of Distinction

Quite frankly, fluorescent street lighting is designed for the above-average community. For fluorescent is the signpost of progress and prosperity. It's a symbol of a town with pride—pride in its people—pride in its government—pride in its hospitality—pride in its capacity to cast aside the old and embrace the new.

This is street lighting that says to the world—here is a good place to live, to work, to play, to shop, to invest. Here is a city well-managed, clean, attractive—a Community of Distinction.

For those fortunate cities whose officials are alert to progress, General Electric offers its services to assure the finest fluorescent street lighting any city can install.

The full story of G-E fluorescent street lighting is told in a new bulletin, GEA-6094. You can get a copy from your nearest G-E Apparatus Sales Office, or by writing to Section 452-159, Outdoor Lighting Department, General Electric Company, 1400 Western Avenue, West Lynn 3, Mass.

*"Out of Darkness," a new, dramatic film story of how one community met its street lighting problems, is now available for showings to civic groups, community service organizations, etc. This 16-mm, sound, black and white movie runs 26 minutes. Borrow a print of "Out of Darkness" from your nearest G-E Apparatus Sales Office.*

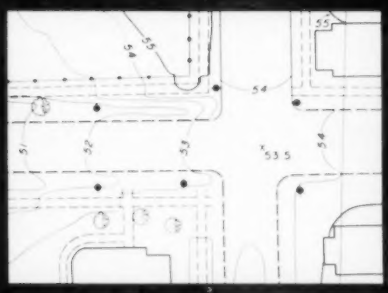
*Progress Is Our Most Important Product*

GENERAL ELECTRIC

Now's the time to mail this month's Readers' Service Card.

# The sky's the limit . . . when we tackle your mapping problems

For stereoscopic study and reconnaisance; area study, planning and location.




For tax valuation and study, industrial site location, annexation, zoning and traffic control.

For design and location of highways, streets, bridges, sewage-disposal plants, flood control, waterways, utilities and public works projects.

Terrain or location is no problem when you rely on the aerial mapping service of Jack Ammann Photogrammetric Engineers, Inc. No place is too distant — too inaccessible — or too rugged for Ammann crews to operate in and still deliver precision maps on schedule.

Ammann maps produced by the latest photogrammetric methods not only meet the most exacting engineering specifications, but they are produced at big savings both in time and money. Weeks and sometimes months are saved over conventional ground survey methods.

If you have a mapping problem — regardless of location or size — call or write our nearest office.

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**PHOTOGRAMMETRIC ENGINEERS, INC.**
BROADWAY AT TENTH — SAN ANTONIO, TEXAS

*In Price Purchasing*

**THE DOWN PAYMENT**

**MIGHT BE THE ONLY EASY ONE**

The purchase of water meters involves more important economic factors than price alone. Actually, the bid price is only your down payment . . . and it could well be the only easy payment.

Any instrument loses its accuracy as it wears. After a few years . . . maybe only a few months . . . an improperly selected meter begins to lose revenue. In time, you'll also have high repair costs . . . or costly scrap-and-replace programs.

Avoid these high costs with Trident meters. Tridents retain accuracy longer . . . derive maximum revenue longer. Most important, you avoid high costs of obsolescence and repair. The most modern Trident parts fit the oldest Tridents you have. You actually modernize as you repair . . . with Trident.

When you consider all these economic factors you will quickly see why Trident meters earn more and cost less. Ask your neighbor . . . or ask us to supply verified evidence.

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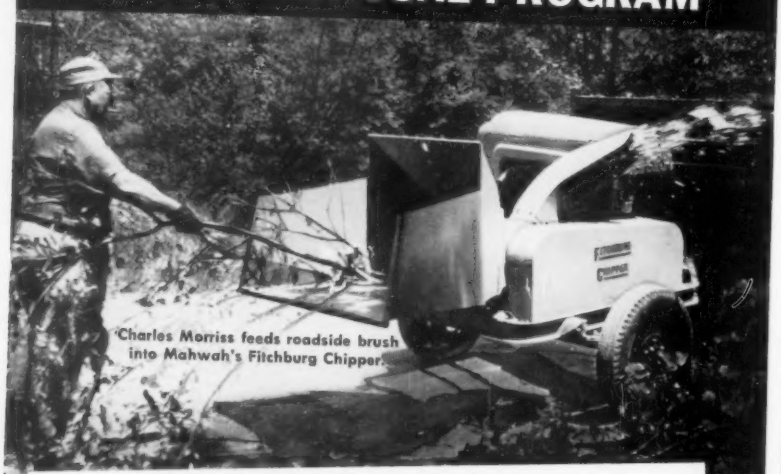
Get full details of this month's products . . . mail your Readers' Service card today.

**FITCHBURG CHIPPER REPLACES 3 MEN**

**in Township of Mahwah, N. J.**

**BRUSH DISPOSAL PROGRAM**



Charles Morriss feeds roadside brush into Mahwah's Fitchburg Chipper.

**TOWNSHIP OF MAHWAH**

MAHWAH

BERGEN COUNTY, NEW JERSEY

Mr. W. O. Forman, President
Fitchburg Engineering Corporation
Fitchburg, Massachusetts

June 9, 1955

Sirs:

I often wondered why it could not be possible to dispose of brush along roadsides when it had been cut. This problem was solved by purchasing a Fitchburg Chipper. Now I chip the brush instead of putting it on piles and waiting for wet weather to burn. I mention wet weather because of fire hazard.

The Fitchburg Chipper was purchased in May 1954. It will take only a short time to pay for itself. I hired six men to cut and clean up brush, now with the chipper I only need three to do the same work.

All brush is cut and chipped the same day, this eliminates unsightly heaps along the roadside. In wooded areas the chips are blown back off roadsides and serve as mulch for forage.

The Fitchburg Chipper is well constructed and does not hesitate to chip wood classified as larger than brush.

The machine is trouble free and easily maintained. I hone the cutter blades once a day to insure fast cutting, and if the blades are damaged they are returned to the factory for repairs, the cost for this is very small.

The Fitchburg Chipper is a well balanced machine and does not sway when trailing it behind a truck. In general I find it very satisfactory for its purpose.

Yours truly,

John Glasgow

JG/wc

John Glasgow
SUP'T. P.W.

*Free Booklet*

Learn how your town or city can CUT LABOR COSTS! Send now for *free booklet.* Tells how a Fitchburg Chipper can solve your brush disposal problem faster and at less cost. Address:

**FITCHBURG ENGINEERING CORPORATION**

**FITCHBURG, MASSACHUSETTS • Dept. PW-16**

Need more facts about advertised products? Mail your Readers' Service card now.

## BOOKS IN BRIEF

### REVIEW OF CURRENT RESEARCH

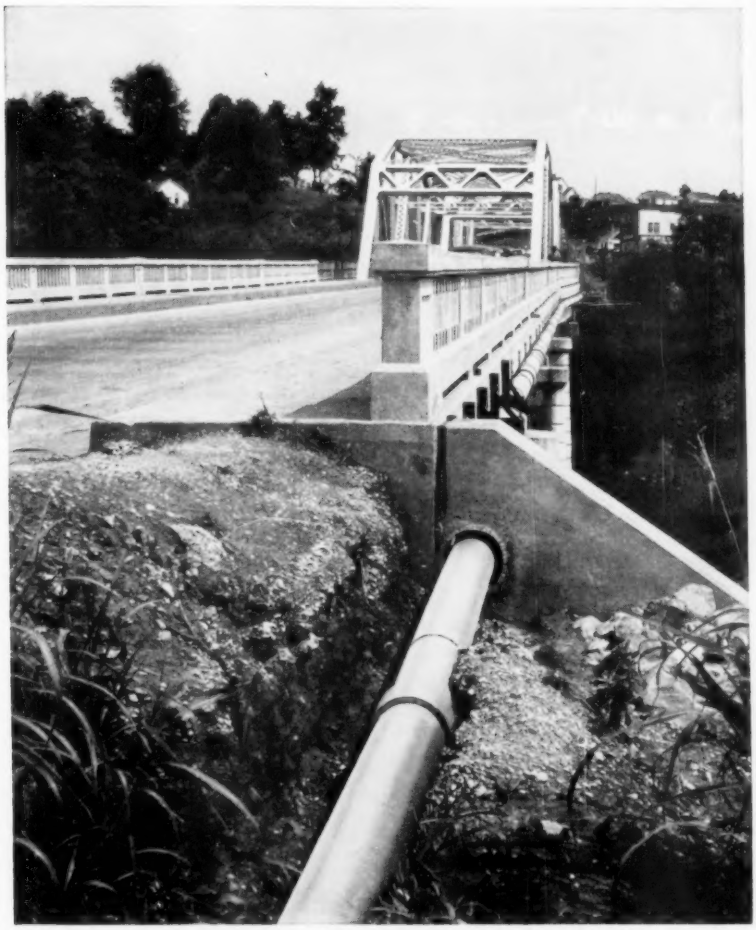
Every two years the Engineering College Research Council publishes a big volume listing the research projects and expenditures at more than a hundred colleges. The current issue, published in August, 1955, covers 105 institutions and reports on 7500 research projects in all branches of engineering and in many related fields. An index covers some 5000 research project subjects. Other data include names of responsible administrative officers, governing policies, expenditures, sources of funds, and special conferences and short courses given at the various colleges. Copies are $2 each from Renato Contini, Secretary, Engineering College Research Council, New York University, University Heights, New York 53, New York.

### PROCEEDINGS OF THE OHIO WATER CLINIC

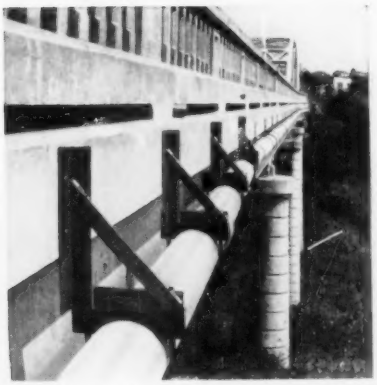
The Proceedings of the Fourth Annual Ohio Water Clinic for 1955 include: "Stream Flow in Ohio in 1954", by Lawrence C. Crawford, Dist. Eng., USGS; "Water in Ohio's Future," by E. Eugene Fournace; "Water Policy Objectives," by C. V. Youngquist, Ohio Dept. of Natural Resources; "Long Distance Water Distribution in Ohio Via Pipelines," by Robert C. Lewis, Southwestern Ohio Water Co.; "The U. S. Dept. of Interior Looks at Ohio's Water Resources," by Clarence A. Davis, Undersecretary of Interior; "Corps of Engineers Looks at Ohio's Water Resources", by Col. J. L. Person; "The USDA Looks at Ohio's Water Resources", by George R. Phillips, U. S. Soil Conservation Service. These proceedings were held under the general direction of Prof. K. W. Cosens, Dept. of Civil Engineering, the Ohio State University, Columbus Ohio. 88 pages.

### CONCRETE FOR WATER AND SEWAGE WORKS

The title of this booklet is "Water and Sewage Works Concrete Improved with Pozzolith." It contains owners' reports on the present day



*In the South!* Suspended from a bridge in Tennessee, "Century" Asbestos-Cement Pipe serves ideally because of its light weight and inherently rugged construction. Made in convenient 13′ lengths, this pipe can be attached to bridge structures with a minimum of time and labor, and be readily cut on the job.



*Absorbs vibration.* "Century" Pipe installations are designed to "roll with the punch." Pipe ends are separated and "float" in rubber gaskets within the asbestos-cement couplings. Vibration of bridge traffic is absorbed by the gaskets and localized to individual pipe sections.

*In the West!* This is part of a 13-mile installation of "Century" Pipe near Tacoma, Washington. Non-metallic, this pipe can't corrode or tuberculate.

# Throughout the Nation, "Century"® Pipe Holds Pumping Costs in Line

"Century" Asbestos-Cement Pipe is winning enthusiastic acceptance in tax-conscious communities across the country, and the reasons are plain. Here is pipe that will carry its rated flow at normal pressure permanently, keeping pumping costs low. "Century" Pipe is made of asbestos fiber and portland cement. It is non-tuberculating, immune to electrolysis, corrosion-proof. Because of its light weight, it is easy to assemble, easy to install. Meets the A.W.W.A., A.S.T.M. and Federal specifications for asbestos-cement pipe.

Free Booklet—"Mains Without Maintenance" gives valuable specifications and reference data for "Century" Pipe. Write for it today.

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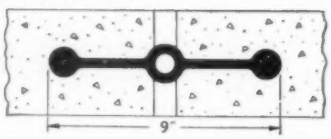
**HOLLOW BULB**—FOR EXPANSION JOINTS

Insures permanent, watertight seals in joints where considerable movement due to expansion and contraction is expected. Flexible and elastic with a very high degree of tensile strength to withstand both lateral and shearing movement. Widths—6" and 9" . . . lengths to order.

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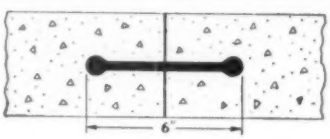
Made of durable, elastic cured rubber which has high tensile strength and flexibility for effective sealing of contraction and expansion joints against hydrostatic pressure. Carefully manufactured to insure dense, homogeneous cross section for greatest service life. Widths—6" and 9" . . . lengths to order.




## SPLIT TYPE WATERSTOP

*faster, easier installation*

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*simplifies Field Splicing*

Permits a faster, simpler method of field splicing, using only rubber cement. The union is hollow and is made from rubber meeting the same specifications as the waterstop. Available for splicing 6" and 9" Dumbbell and 6" and 9" Hollow Bulb Waterstops. Pat. Pend.

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The plan and content of this book has grown out of the training program of the Bureau of Highway Traffic at Yale University. The authors explain highway traffic phenomena by simple and elementary analysis and show how highway traffic treatments are founded in restrictive methods on one hand and constructive measures on the other, both of which take place in the environment of administration and planning. This book is an excellent reference for those engaged in highway traffic planning operations and administration, and a superior text for traffic engineering training courses. Authors are Theodore M. Matson, Wilbur S. Smith and Frederick W. Hurd. McGraw-Hill Book Co., Inc., 330 West 42nd St., N. Y. Price $12.50.

### SPECS FOR DEEP WELL VERTICAL TURBINE PUMPS

A new American Standard for vertical turbine pumps handling water from deep wells has been published by the American Water Works Assn. These specifications, known as ASA B58.1-1955, include a table of standard nomenclature, engineering data, and factory inspection and tests. Both water-lubricated pumps and oil-lubricated pumps are covered. 25 pages. Copies may be obtained from the American Water Works Assn., 521 Fifth Ave., New York 17, N. Y., upon advance remittance of 50¢ per copy.

### ELECTRONICS DICTIONARY

A revised edition of "A Dictionary of Electronic Terms" contains over 3,500 terms used in television, radio and industrial electronics. The book was edited by Gordon R. Partridge, Associate Professor of Electrical Engineering, University of Purdue. 72 pages; more than 150 illustrations; pocket size. 25 cents from Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill.

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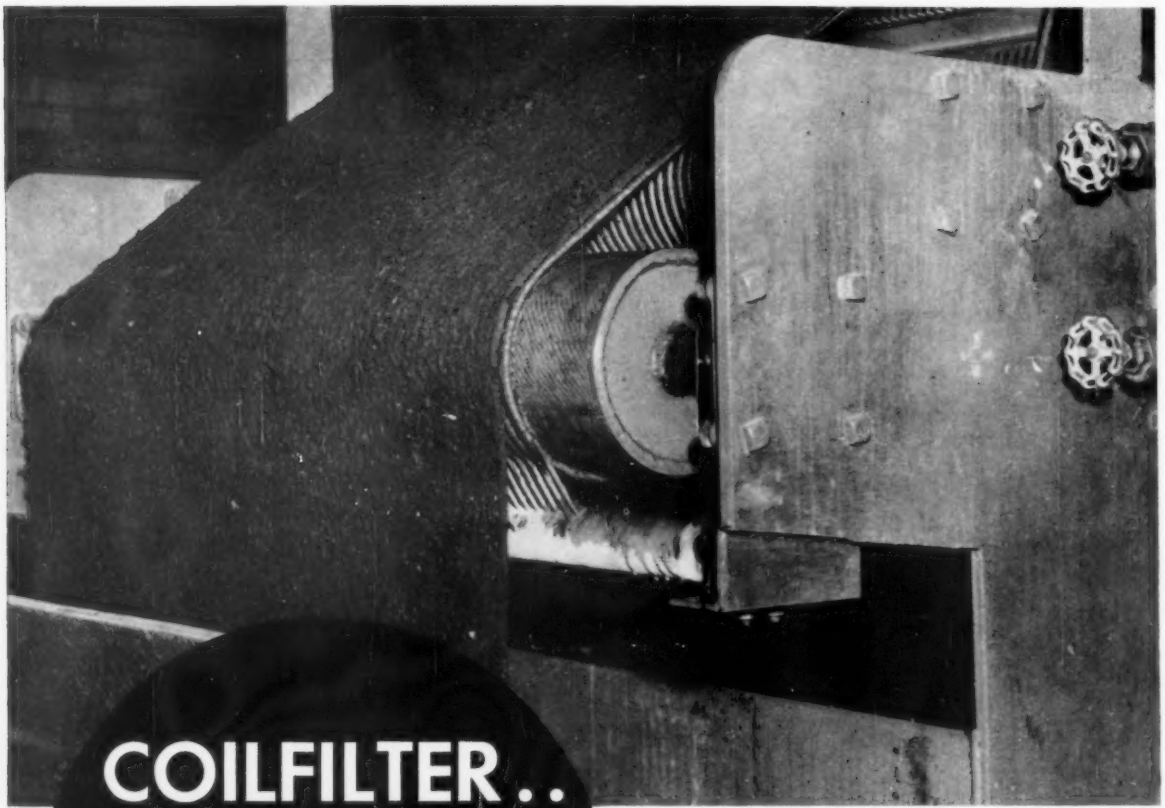

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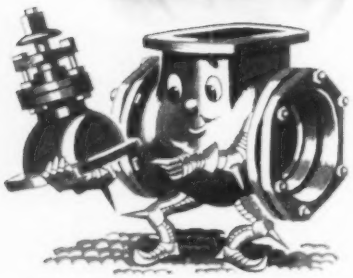

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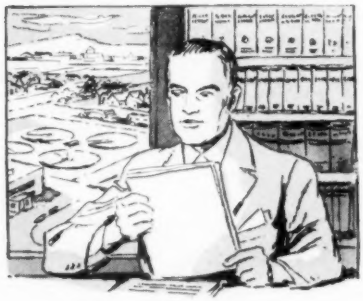

**MELVIN NORD, Dr. Eng. Sci., LL. B.**

**Registered Professional Engineer**

### *Water, Water, Everywhere*

The case of Bennett v. The County of Eaton, 65 N.W. (2d) 794, (Mich., 1954), raises the question: "When is a road a canal?"

The plaintiff, John Bennett, owned a home and farm situated on the east side of Canal Road. In the summer of 1949, the Eaton County Road Commission, the defendant in the case, reconstructed Canal Road. Prior to that time, the road was in poor condition, particularly during the spring of the year. Water used to run down the middle of the road and collect on it. As a result vehicles became mired, and the road was virtually impassable. At times, the road had washed out. In fact as a road, Canal Road was a complete washout, but as a canal it was pretty good.

In 1949, the Road Commission reconstructed Canal Road as a crowned gravel road thirty feet in width, and since that time it has always been in good condition for traffic. Following the improvement of the road, ditches were constructed along both sides of the highway. Two tile culverts about 14 inches in diameter were placed under the road, connecting the east and west ditches.

Before the improvements were made in the road, surface water flowed naturally off the road over a broad area, and was distributed in relatively small amounts over the property of Bennett and his neighbors. After the "improvements", however, the flow of water off the highway has been concentrated onto Bennett's land in the vicinity of his house, and has flooded his land to such an extent as to ruin it for farming purposes. The reason for this accumulation of water is that a curve in the road was banked to the west in such a way as to prevent the overflow of water in the normal way. Instead, the water collects in the west ditch, runs through the culvert to the east ditch, and finally overflows in a mighty stream onto Bennett's land.

In his suit against the Road Commission, Bennett asked for a mandatory injunction compelling the removal of the culverts, and damages of $1000 for the injury to his land. The issue was whether public authorities have a right to divert surface water so as to concentrate it and cause it to pour in great quantity and velocity onto the land of a private person.

The court held that the mere fact that sound highway engineering principles were used was not sufficient to warrant such interference with a person's use and enjoyment of his land. It is a taking of a property interest without due compensation. If it is necessary to do such a thing, it can legally be accomplished only through the exercise of eminent domain, with fair compensation. Since this was not done, the plaintiff was given the relief requested.

The moral of the story seems to be: "Even though you know the lay of the land, you can't bank on it."

### *Repavement of Streets*

An interesting legal problem is presented in City of Philadelphia V. O'Brien, 107 Atl. (2d) 587, (Pennsylvania, 1954),—namely whether or not the owner of property must pay an assessment for the repaving of his street.

The court held that although a city can assess abutting property for paving a street, it cannot assess it for re-paving it. The original paving is regarded as a special benefit to the abutting land. The repaving is regarded as the mere fulfillment of the duty of the city to maintain streets in good condition, and is not a special benefit to the abutting property.

As to what constitutes original

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Although sections of this 48" Lock Joint water supply line for Hartford, Conn. were uncovered by the flood, it continued to give satisfactory service.

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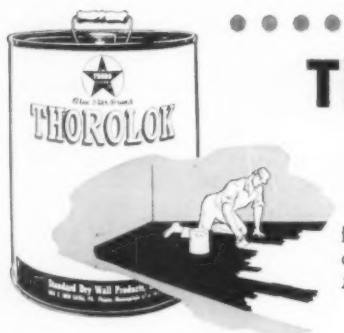


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paving, the court declared: "While no particular material is necessary to constitute such pavement, it may be made of anything which will produce a hard, firm, smooth surface for travel. There is no question but that macadamizing may be regarded as a first paving if it was the intention of the municipal authorities to so use it. Not all macadamizing, of course, converts a road into a street. The character of the work must be shown".

An additional complicating factor in the present case was that the city had not made any assessment at the time of the original paving. It was held, however, that this is not of crucial significance. Failure of the city to assess abutting property is no proof that the original work done was not paving. And if it was paving, there can be no assessment for re-paving. The city eventually loses its right to assess for paving a street, and it cannot regain this right by repaving the street.

### *Objections to Sewage Plant*

In Lees v. Sampson Land Co., 372 Pa. 126; 92 Atl. (2d) 692, twenty-four owners in Penn Township, Allegheny County, owning land close to a 150-acre tract owned by the defendant company, sought to enjoin the erection of a sewage treatment and disposal plant. The defendant company had offered to build the plant on their property at their own expense and turn it over to the township free of charge. The township had accepted the offer and agreed to operate the plant.

The plaintiffs claimed that the plant would be a nuisance per se, and would in addition, violate a zoning ordinance of the township restricting the area to residential uses.

The court held that the zoning ordinance was not being violated,—first because the ordinance specifically permitted "municipal uses," and second, because the municipality had the power to abrogate its own ordinance insofar as this particular property was concerned.

The court further held that the sewage plant would not consitute a nuisance per se, in view of the fact that it was similar to those operated in other residential municipalities in the county with no untoward effects on health and real-estate values, and would not be unsightly or emit offensive oders.

The injunction was therefore refused.

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# Specifies

# CLAY PIPE

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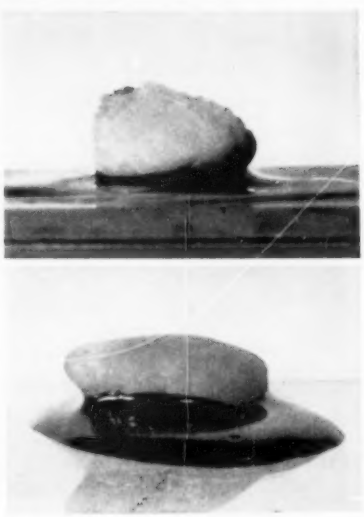

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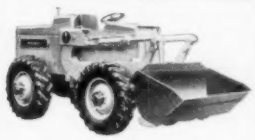

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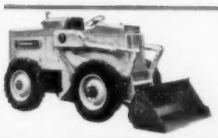
**1½ cu. yd.**



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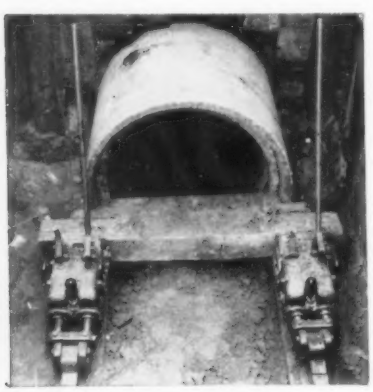

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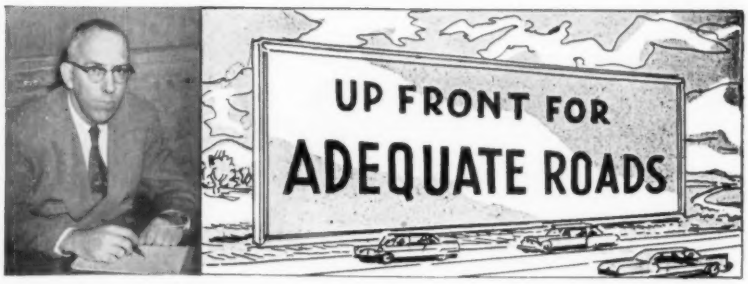



by LEO J. RITTER, JR.

**Highway Research** — "Experience is a great teacher, but by itself it may only deepen a rut. Experience coupled with study and research may produce revolutionary improvements . . . . Without the search for new knowledge, for understanding of it and for ways to use it, the lessons of experience would be learned to little profit." These are the words of the late Roy W. Crum, former Director of the Highway Research Board. They appear on the cover of the November, 1955 issue of "Highway Research Review", a 184-page summary of national activities reported by the Highway Research Correlation Service. In it are listings and brief descriptions of hundreds of research projects, activities, and publications in every area of street and highway engineering and from all parts of the country. For example, are you interested in sufficiency ratings? On page 157 of the Review you will find a listing of the states which have developed or are in the process of developing rural and urban sufficiency rating systems; there also is a listing of 10 HRB publications relating to this subject. Interested in the problem of joints in concrete pavements (I happen to be, at the moment)? You'll find information about others who are interested in this problem under several headings, including Crack Control, Experimental Roads and Installations, Load Transfer, Maintenance, Measurement of Openings, Sawing, Sealing Operations, Sealers, Spacing, and Surveys—nearly 6 pages of listings in all. In the entire booklet, 886 research projects which are either under way or have been completed within the last five years are listed. It is apparent that vital research is not being neglected in our field of interest.

**Slurry Seal Coat** — A very interesting new (at least to us) approach to the problem of repairing cracking and spalling of bituminous pavements is detailed in an article in the September-October issue of *California Highways and Public Works* by Merle L. Nelson. The article reports the results of experiments by the state highway department using a slurry seal developed by the City and County of Los Angeles. The slurry consists of a combination of fine sand or crusher dust (or both) with a mixing grade of asphalt emulsion and water. A very wet slurry is formed, with typical proportions of a batch being one ton of aggregate (dry weight), 25 gallons of water, and 47 gallons of emulsion. The slurry can be mixed in an ordinary transit mixer, with the amount of water being varied to suit conditions.

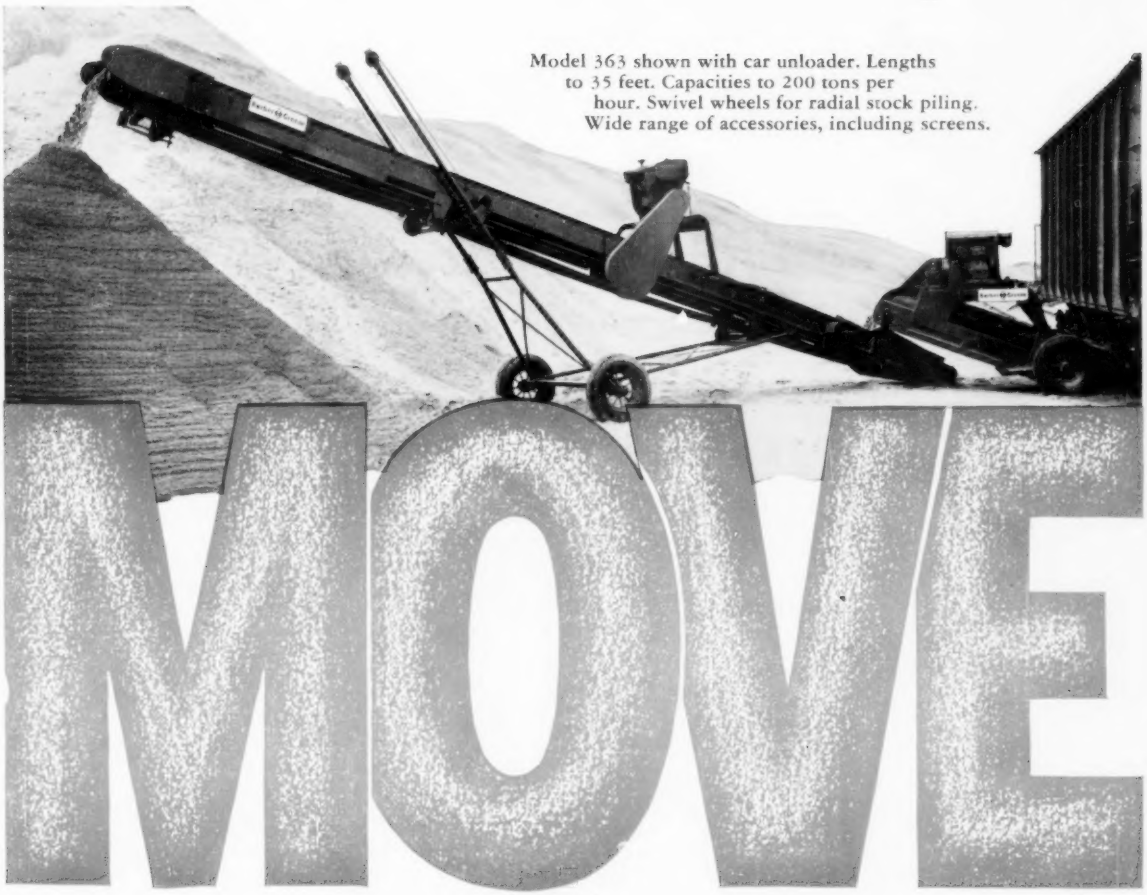
Experience shows that the aggregate should conform reasonably closely to the gradation shown in the table herewith.

**Table 1—Slurry Aggregate Grading**

| *Sieve Size* | *Percent Passing* |
|---|---|
| No. 20 | 100 |
| No. 30 | 91 |
| No. 50 | 54 |
| No. 100 | 20 |
| No. 200 | 3 |

In preparing the slurry, the emulsion and water are put in the mixing drum and the aggregates added slowly to prevent balling. Approximately five minutes is required to add the aggregates. The pavement to be treated is sprinkled with water, usually about 0.10 gallon per square yard. The slurry is poured from the mixer onto the pavement inside a specially constructed spreader box consisting of a rectangular frame one lane in width. It is equipped with a rubber squeegee which forces the slurry into all cracks and depressions in the pavement as the spreader is towed along the pavement. A very uniform, rejuvenated pavement results. Under normal weather conditions, the new surface can be opened to traffic in 1½ to 3 hours after application.

Results of the experiments with the slurry coat are reported to be highly successful.



Model 363 shown with car unloader. Lengths to 35 feet. Capacities to 200 tons per hour. Swivel wheels for radial stock piling. Wide range of accessories, including screens.

# MOVE

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Model 374 shown with flanged wheel for radial stock piling. Available with steel wheels or pneumatic tires. Lengths to 60 feet. Capacities to 430 tons per hour. Wide range of accessories, including vibrating screens.

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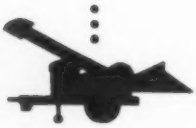

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**Timber Piles** — A nice, shiny new booklet entitled "Pressure Treated Timber Foundation Piles" is now available from the American Wood Preservers Institute, 111 W. Washington Street, Chicago 2, Illinois. It was written by W. D. Keeney, Ralph H. Mann, and Miles Burpee of the Institute staff and is an up-to-date and authoritative treatment of the subject. It carries a price tag of one dollar, but I am not sure they really mean it.

**1956?** — This is the time that columnists normally make predictions for the new year, but this one can't seem to get in the mood. One thing is for sure—there is going to be a tremendous hassle and an unprecedented amount of lobbying (on both sides) in the Federal Congress over the new highway bill. With this being an election year, who can predict the outcome? Since the present federal-aid law expires June 30, some sort of bill will have to be passed. There's bound to be more money provided than ever before, but how much more? Another thing that's certain—the Chicago-New York nonstop (except to pay tolls) highway is going to be a reality next year, or mighty close to it. Some of the other badly needed projects are going to be completed, too, and will provide relief in some areas. Overall, though, the traffic isn't going to change too much—the problem is just too big, with an ever-growing population and those characters in Detroit turning out automobiles like crazy.

**WASHO Test Road** — The Highway Research Board has issued a voluminous report on the effects of heavy trucks on asphalt highways. The report is a result of the studies made by the Western Association of State Highway Officials on a test road in Idaho in 1952-54. Three of the major conclusions of the report are (1) that asphalt pavements of the type being used on main highways can carry the heaviest legal truck axle loads and more; (2) that even in the wet spring months, asphalt pavements of the standard designs are strong enough to suppport heavy trucks; and (3) that shoulders on new and existing asphalt roads should be paved to increase strength, prolong life, and reduce maintenance costs.

**Big Town**—Efforts continue by the City of New York to ease the big town's traffic headache. Among recent developments are these. Laying of plans for the construction of two new city-financed parking garages — one underground — in

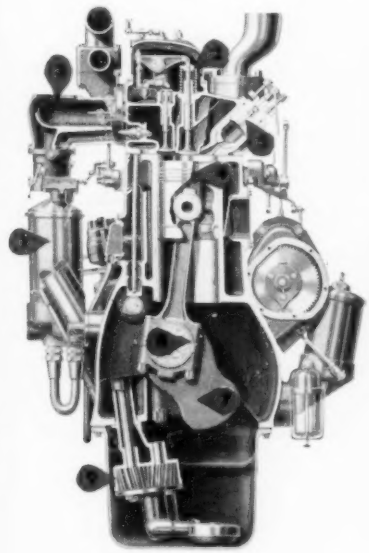
**1 FULL FLOW OIL FILTER**—Before oil goes under pressure to engine bearings, all harmful particles are removed by replaceable plastic-impregnated, full-flow filters.

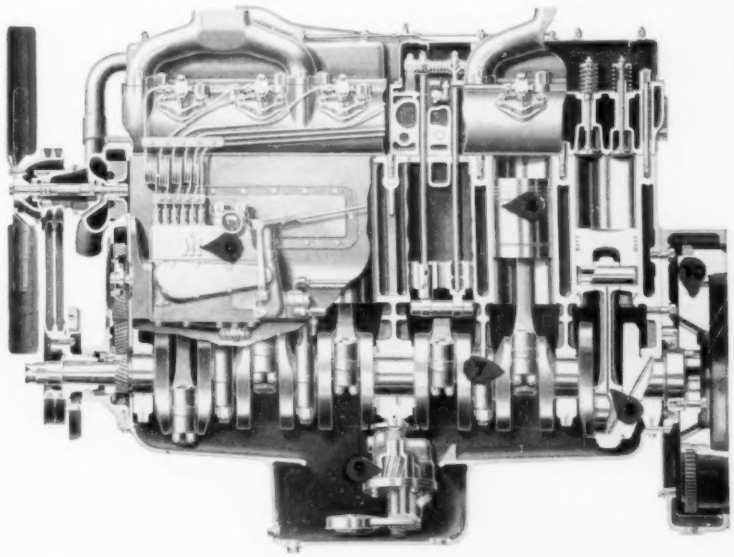
**2 POSITIVE ROTATORS EXTEND VALVE LIFE.** Exhaust valve rotators keep valves turning, at all engine speeds, distributing heat uniformly around the valves to keep deposits from building up on stems and seats, and also to prevent sticking, scuffing, and burning.

**3 POSITIVE ALL-WEATHER STARTING.** Seconds-fast, International Diesels start in coldest weather on exclusive gasoline starting system. Cylinders are pre-heat conditioned to give complete, clean combustion, instantly, on switching to operation on Diesel fuel.

**4 ALUMINUM-ALLOY PISTONS** have a thick crown at the top for rapid dissipation of excess heat direct to the cooling water. Hardened, replaceable, cylinder sleeves, three compression rings, with top ring chrome-plated, plus two oil control rings assure long-lasting, gas-tight seal for high compression ratios of over 15 to 1 . . . providing top fuel and oil economy.

**5 SIMPLE, SINGLE-HOLE, INJECTION NOZZLE** and pre-combustion chamber set at 45° angle for smooth, clean combustion of low grade No. 2 fuel oil under all engine speed and load conditions.





**6 NEW IH INJECTION PUMP:** Single plunger type on four-cylinder models, twin-plungers on six-cylinders . . . provide all cylinders equal amounts of fuel, precisely metered to load, whether for idling, maximum horsepower, or maximum torque under overload. New, harder injection plungers have up to four times longer life.

**7 HEAVY-DUTY FORGED CRANKSHAFT** with large diameter, induction-hardened journals provides long-lasting, wear-resistant bearing surfaces . . . rifle-drilled for full pressure lubrication . . . dynamically balanced for smooth operation.

**8 REPLACEABLE TRI-METAL BEARINGS** provide precision clearance for full-pressure lubrication and thousands of hours of heavy-duty work. Smooth electroplating of white alloy metal over copper-lead, precision bonded to a steel back, carries heavy loads with minimum friction.

**9 FULL-PRESSURE LUBRICATION** for long life. Big, gear-type pump delivers oil under controlled pressure through full-flow filters and rifle-drilled passages to main and connecting rod bearings, piston pins, camshaft, timing gears, and valve rocker arms.

**10 HEAVY FLYWHEEL** helps to maintain uniform speed under widely varying load conditions. Available to match standard makes of clutches, fluid couplings, and torque converters.

# *Hour after hour. . year after year*

# INTERNATIONAL ENGINES

## . . . stay on the job with least upkeep

All International engines are built throughout to give you a full measure of power that stands up and stays on the job. They are precision-manufactured of thoroughly tested materials under continuous, quality-control inspection. Pressure lubrication through rifle-drilled crankshafts and internal passages assures trouble free performance. Inbuilt precision is fully protected from dirt and grit under the worst of job operating conditions by the best of fuel, oil, and air filters.

Heavy-duty radiators, power take-offs, and other factory-engineered power unit components are available to fit these long-life, money-saving engines to your job requirements. You can also get them as original equipment in most makes of construction machines. Call your nearest International Industrial Power Distributor or Power Unit Dealer for all the facts.

**There's a size and type of International engine to fit your needs . . . from 16½ to over 200 hp.**

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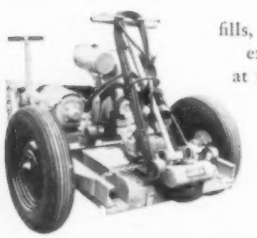
**INDUSTRIAL POWER**

**MAKES EVERY LOAD A PAYLOAD**

**Positively THE MOST EFFICIENT MEANS OF BLACKTOP PATCHING PAVING DRIVES, WALKS, ETC.**

The compactor member of this outfit is self-propelling, the operator has only to guide it. It delivers up to 4500 1¾ ton blows per minute and will compact bituminus mixes in 4" to 5" layers close to maximum density — at the rate of 1800 to 2000 sq. ft. per hour. The compactor is operated from a Jackson Power Plant on an auto trailer, and since the trailer has a device for quickly picking up the compactor, it is a very mobile outfit, ideal for the many changes of location required in street patching, paving drives, walks, railway crossings and the many similar blacktop applications in which it is so widely and successfully used.

**EQUALLY EFFICIENT IN COMPACTING GRANULAR SOILS**



in trenches, sub-bases for concrete floors, backfills, etc. With the JACKSON Compactor densities in excess of 100% of those specified are readily achieved at the rate of 2000 sq. ft. per hour in layers as thick as 10". Let us give you the name of the nearest Jackson Distributor where you can see and inspect this great time and money saving equipment.

**JACKSON SINGLE COMPACTOR TRAILER-POWER-UNIT**

Jackson Compactors are also available in "twin" units, either in tandem or side-by-side hook-ups, and since they are self-propelling, one man thus can easily operate two compactors. Production is practically doubled in this way and labor costs halved. Twin unit auto trailer carrier is available.

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downtown Brooklyn. Approval of a request for authority to acquire a site for a 343-space parking field in the Jamaica area in Queens. Extended use of one-way streets, parking meters, progressive signal timing, alternate side parking in various areas, intersection improvements, and many other steps to aid traffic movement over existing streets.

**Illinois Toll Roads** — The Illinois Toll Road Commission sold $415 million of revenue bonds late in October, marking a milestone in the stormy path of this state's toll program. Construction is expected to begin in May of next year, with target date for completion of part of the program the end of 1957. The interest rate for the bonds was a whopping 3.83 percent, highest we've heard of in recent years for this type of bond issue. Why so high? —(1) unfavorable market conditions; (2) dumping of the whole issue on the market at once; and (3) type of bonds (secured by toll revenues only). Marked by poor management and terrible public relations thusfar, we can only hope for better performance from here on. Political opponents of Governor Stratton and his administration are liable to make hay from the toll road program.

**Round and About** — Believe it or not, the standard-size license plate (6 by 12 inches) is now virtually assured for all states by the end of next year; I don't suppose it makes much difference to anybody except the car manufacturers, but it must be progress. The 123-mile toll road from the New York Thruway to Boston will be opened to traffic January 1, 1957; the pavement structure will be 14 inches of frost resistant gravel, 5 inches of macadam base, and 6 inches of bituminous concrete. A new approach to the problem of financing a greatly accelerated national highway program has come from T. S. Petersen, President of Standard Oil of California; he suggests a greatly broadened tax base to include all those who benefit directly or indirectly from public roads—this would include manufacturers of paving materials. The white shoulder line for increased safety in night driving seems to be gaining in popularity, with applications being made in ten or more states. General locations of the final 2300 miles of the 40,000-mile National System of Interstate Highways have been approved by the Bureau of Public Roads.

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## *FURNISHED TO YOUR SPECIFICATIONS IN LOTS OF 1 OR 100!*

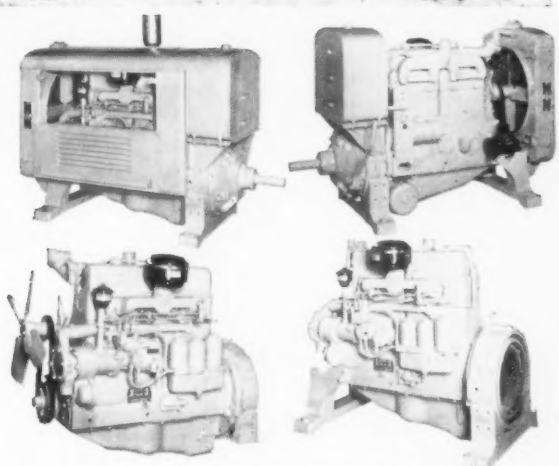
You get power adaption that fits your specifications more readily with Minneapolis-Moline engines. Why MM? Because, as an independent engine builder, no single sales outlet dictates MM engine design—and MM works in such a big variety of power applications.

To meet a wide range of basic requirements MM engines have large displacement for high torque at moderate rpm. Extra high compression and high turbulence combustion combined with high volumetric efficiency provide outstanding performance.

For these reasons MM units are ready to go when equipped with specified operating accessories. You eliminate major auxiliary unit purchases to adapt engine characteristics to meet momentary high load demands. Further long run benefits are low fuel consumption and low maintenance that total up to low cost production.

Every-day experience in supplying a wide range of unit requirements enables MM to maintain customary high quality in single or small lot quantities at reasonable cost.

A high degree of standardization results in high production parts that provide precision fits and permit MM to schedule parts for special units in large quantity, assuring early delivery and customer service.



MM engines are completely engineered and equipped for gasoline, LP gas, natural gas, or distillate fuels. Sizes range from 206 cu. in. portable units to 1600 cu. in. stationary engines and are available for fan to flywheel application or completely enclosed leg mounted installations. MM also builds a line of industrial Diesel power units: Sizes—283-, 425-, 605 cu. in.

Standard equipment includes vacuum crankcase ventilation, thermostat controlled bypass cooling, packaged water pump, built in variable speed governors, enclosed gear driven oil pump, and oversize full-flow oil filters (shunt-type filters are provided exclusive on MM Thermo-Clad units).

Send details on your application for examples of MM built-to-order packages for original or replacement needs. Engineering service available for pumps, hoists, crushers, generators, shovels, ditchers, cranes, compressors, feed mills, saw mills, planing mills and similar installations. When you want dependable performance year after year from your engine, you want an MM Industrial Power Unit.

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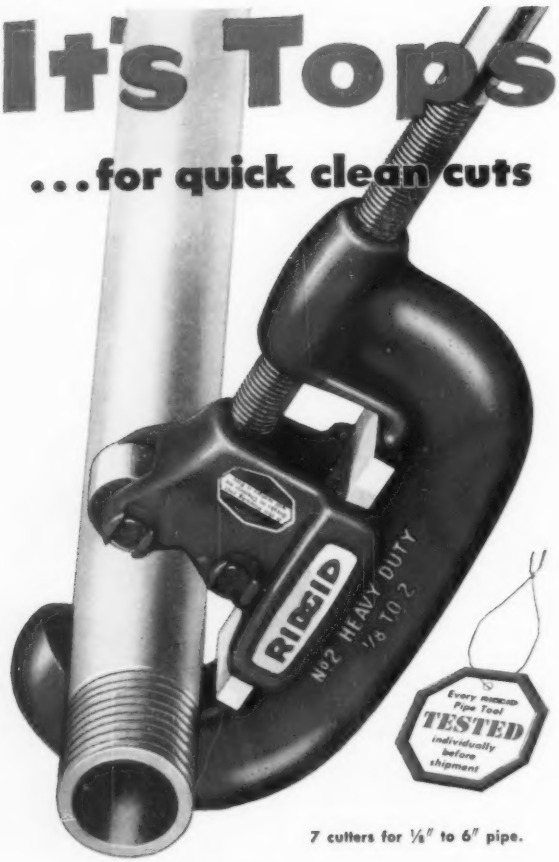


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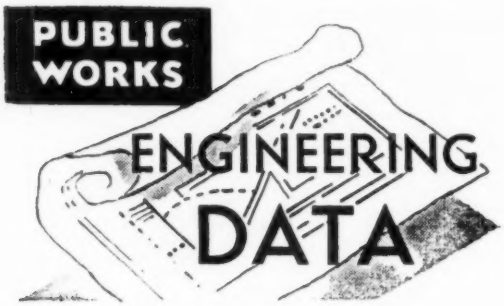


### Effects of Floods on New York State Water Supplies

There were a number of occurrences in New York State in 1954 where local floods caused damage to municipal water works structures due to heavy local rainfall and run-off, according to Joint Legislative Committee Report on Natural Resources.

In one city, due to heavy run-off, a diversion tunnel collapsed and permitted untreated water to enter the distribution reservoir. Fortunately, the reservoir could be by-passed and the entire city supplied with water until such time as the diversion tunnel could be repaired.

One water supply had the supply line torn out for relatively long distances due to local heavy run-off. This required emergency measures and the use of an emergency supply for an appreciable period of time until major repairs could be made. Another supply had the main from their upland source completely washed away, but normal service was maintained from an auxiliary supply secured from wells.

Of particular interest is one of the small cities which had recently installed diesel standby pumping equipment. Their electrically driven pumping unit was completely out of service for about 24 hours but they were able to maintain normal service by immediately switching to the diesel driven pumping unit. The city had just completed the installation and received a very definite lesson in the value of installing auxiliary power for use in cases of emergency.

The hurricane resulted in the shut-down of electrically driven pumping stations, particularly in the Long Island area. However, reports indicate that either auxiliary pumping equipment was available or an adequate supply was maintained through interconnections with other sources of water supply. Experience following the hurricane clearly indicated the value of auxiliary power and inter-connections in maintaining normal water supplies during periods of emergency.

### Michigan Water and Sewer Needs Assessed

Nearly $1 billion should be spent in Michigan on municipal water supply and sewerage in the next decade, according to a recent Water Resources Commission survey. Needs range from more than $200 million for Detroit to a few thousand dollars for small towns, with sewerage requirements leading 5 to 4.

Estimates are admittedly rough. Of the 352 municipalities canvassed, 72 percent, representing about 94 percent of the total urban population, replied to the mailed questionnaire. Returns show breakdown into water production, distribution, and storage and sewerage collection and treatment categories.

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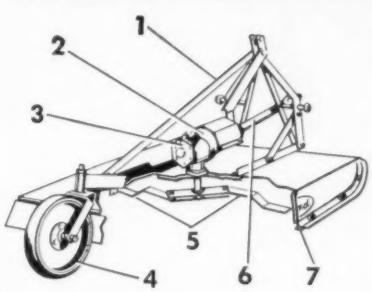


1. Heavy angle frame
2. Friction-type clutch instead of shear pins
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5. Heat-treated blades swing back when an obstruction is hit
6. Heavy-duty Universal Drive
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## FORD Rotary Cutter

**Where heavy weeds and small brush would mean slow, difficult and often impossible mowing with an ordinary mower, the Ford Rotary Cutter attached to a Ford Tractor does a fast, clean job.**

***It saves time*** **. . . works up to 300% faster than conventional mowers. Mows a full 5-foot swath . . . adjusts to a positive cutting height from 2 to 10 inches. And, since it attaches to Ford Tractor's 3-point hitch, it mows *behind* the tractor.**

***It saves money*** **. . . costs less to buy, less to operate and maintain. No belts to replace . . . no sickle bars to buy.**

**Find out for yourself how you can maintain more miles of roadside per day, and at less cost, with a Ford Tractor and Rotary Cutter. See your nearby Ford Tractor and Equipment Dealer or write to the address below for free literature.**

**TRACTOR AND IMPLEMENT DIVISION**
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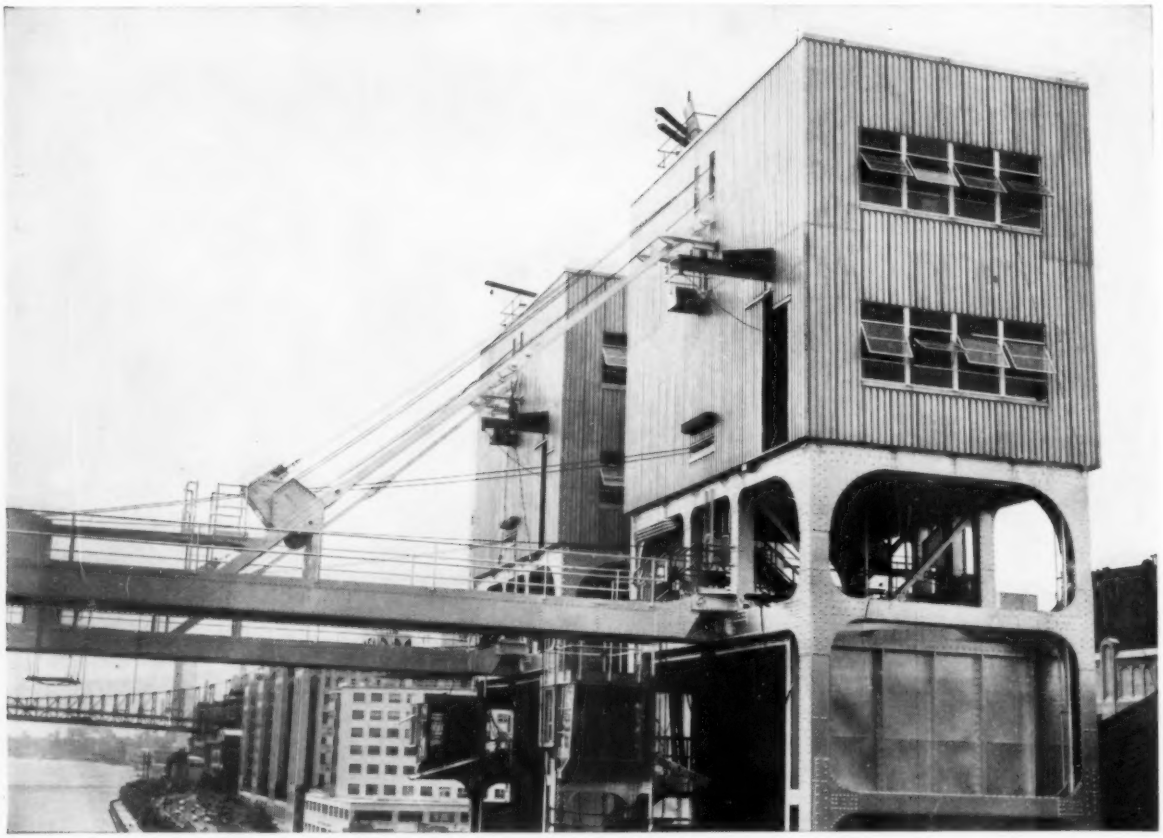

**FOR GOOD RESISTANCE** to coal gas, chemicals and chemical fumes, the New York City Transit Authority selected a Parlon-based paint for these new coal unloading towers. The tower was designed and built by Mead-Morrison Div. of the McKiernan-Terry Corp. The paint is RIW Korosist Chlorinated Rubber Base Paint, manufactured by Toch Brothers, Staten Island, New York.

Across the nation an ever-increasing number of municipalities are discovering the unique properties of paints based on Hercules Parlon (chlorinated rubber).

Wherever protective coatings must stand up to a demanding challenge—whether the requirement be traffic paint, or for a sewage plant; exterior finishes for masonry buildings, or interior protection for metal equipment—Parlon-based paints are providing longer service at lower long-term cost.

Parlon's unusual ability to withstand the corrosive effects of chemicals and salt water atmosphere plus its adaptability to masonry, wood and metal surfaces makes it the ideal all-purpose maintenance paint. Your local paint supplier can provide additional information, or write direct to Hercules.

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# MODERN LIGHTING

## FOR A SHOPPING CENTER AND PARKING AREA

JUST outside the city limits of Nashville, Tenn., on Hillsboro Road within easy reach of approximately 75,000 people, the Green Hills Village Shopping Center has just been completed. Its value, including fixtures and inventories, is estimated at between $5,000,000 and $6,000,000. It contains over 185,000 square feet of floor space and houses 21 different stores, including the following classifications: Department store, ladies wear, five & ten, drug store, shoes, children's wear, cameras and gifts, luggage, flowers, restaurant, cleaners, super market, hardware, barber shop, a bank and an electric company. The general store area, measuring 125 feet by 755 feet, is constructed in two levels with service to the rear lower level and sales on the upper front level. It required approximately 15 months to construct. The buildings are of reinforced concrete, steel and masonry with a variety of interior and store front finishes are virtually fireproof. All wiring is underground. Heating is by gas generally and there are well over 1,000 lighting circuits and almost 600 hp of electric motors. Store hours are 10 AM to 6 PM Tuesdays, Wednesdays, and Saturdays and 10 AM to 9 PM Mondays, Thursdays and Fridays.

The parking area alone cost approximately $80,000. It is the largest single parking area in Nashville and will care for nearly 1200 automobiles. Parking spaces are 9 feet wide with 65 feet between sections. The ratio of parking to shopping space is 4.5 to 1, whereas in most centers it is only 3 to 1. There is also a "cruising" lane that circles the building for the purpose of allowing easy access to stores for customers to pick up packages and people who might be waiting for them.

For the parking area, 29 octagon shaped, continuous tapered Kerrigan Weldforged steel standards, mounted 30 feet apart, provide adequate light. These poles are 25 feet tall; 23 have 6-ft. twin brackets and six have 6-ft. single brackets, anchor base type; all are made from #11 gauge, low alloy, high tensile steel. GE and Sylvania lamps floodlight the area. Numbers are painted on light standards so that shoppers can easily locate their parked cars, either day or night.

The project was conceived by W. H. Criswell, Nashville realtor, and is owned by Criswell and William C. Weaver, Jr., an insurance executive. Hart, Freeland & Roberts was architect-engineer; E. C. Horn, mechanical engineer; and Wm. C. Alford, landscape architect. General Contractor on the job was W. F. Holt & Sons, all of Nashville, Tennessee.

● **DAYTIME view of shopping center area showing parking lot and lighting units. Numbers not yet placed on standards.**

● **NIGHT view of Green Hills Village Shopping Center in Nashville area, showing high level of pavement illumination.**

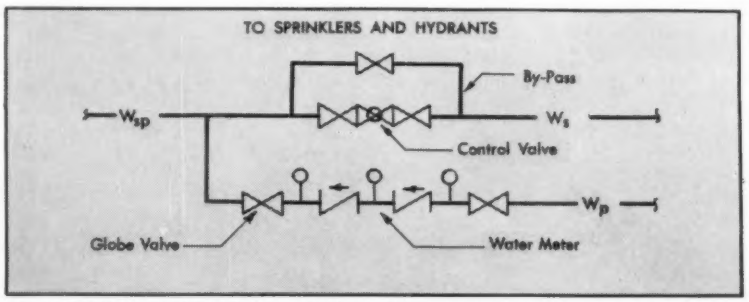
# DESIGN FOR
# FIRE PROTECTION
## USING SEA WATER SUPPLIES

**ROBERT E. PROCTOR,**
Sanitary Engineer,
Porter, Urquhart, McCreary & O'Brien
Los Angeles

SUBSTITUTION of sea water for potable water to supply fire demand is common for military and industrial installations on ocean island and shore installations where fresh water is scarce or unavailable. Additionally, where sea water is used for fire protection it frequently also supplies the cold water shower and sanitary water closet flow.

The chief problems encountered in the design of sea water distribution systems are fouling by marine organisms and corrosion. Corrosion-resistant materials for valve and hydrant trim are readily procurable and chemicals for inhibiting marine growths are reliable; however, special materials as well as the equipment for supplying chlorine, copper sulfate and other algicides are expensive and in the design of automatic sprinkler systems, especially the closed types, the cost of special materials for the larger installations becomes prohibitive.

In the engineering of a sea water distribution system for fire protection and for sanitary flow where fresh water was costly, the author studied and evaluated the usage of corrosion-resistant materials for pumps; piping; hydrants; gate, altitude and check valves; and such sprinkler essentials as deluge valves, risers, laterals and heads. The estimated cost of this utility and its lack of dependability prompted the design of the system which is presented schematically in the accompanying sketch. Its feature is that fresh water is used to sustain the hydrostatic pressure, or head, on the sprinklers and hydrants and to supply the initial flow, while salt water provides the subsequent and larger flow. It is proposed, also, to use fresh water to purge or flush all salt water from the system after a fire or test. By keeping selected branches and mains of the fire protection system filled with fresh water during periods of no flow, it is possible to use standard materials in these sections, with a consequent saving in first and maintenance cost.




● **ALTERNATE METHOD for potable water supply connection to the head tank shows backflow prevention device. Symbols are noted in the legend on opposite page.**

The suggested arrangement may be used for all types of sprinkler systems including fixed temperature, with either wet or dry pipe; and rate-of-temperature rise with either sealed or deluge heads. A residual pressure of 15 to 20 psi at the sprinklers during full fire flow, which may be as high as 12,000 gpm in aircraft hangars, is the usual criterion from which the necessary hydrostatic head is computed. This pressure may be sustained by a constant-head tank supplying fresh water or by a direct connection to the fresh water piping through a backflow prevention unit. The latter may comprise check, gate and globe valves, or it may consist of two or more check valves, an automatically operating differential relief valve (between the checks) and two gate valves, which function on the reduced pressure principle. Fresh water, which fills the mains, hydrant branches and sprinkler piping up to the deluge valve in the open head type and up to the heads in the closed type, is available instantly.

When a sprinkler head fuses, when a deluge or dry pipe valve is tripped or when a hydrant is opened, the flow of fresh water results in a pressure drop downstream from the control valve. A pilot-valve responsive to the fall in pressure opens the control valve to full area, permitting saline water to flow into the sprinkler-hydrant piping. The control valve may be the open-closed type of one-way altitude valve, pilot controlled; a butterfly valve with pilot valve cylinder operation; or a solenoid valve. If a fresh water head tank is employed it should be a vertical type with a height greater than its diameter to provide a rapid fall in head or diminution of pressure in the system at the beginning of fresh water flow. The capacity of the tank must depend upon the judgment of the designer, based on the fire demand and the characteristics of the valve selected. After the control valve has opened to admit sea water to the piping, fresh water will continue to flow into the system from the head tank or through the backflow prevention unit. Although the fresh water piping will be of small diameter, since it does not have to

supply full fire flow for the duration of the fire, it is desirable to provide a globe valve on the fresh water line for selective variation of the flow as dictated by the nominal pressure sustaining requirements and the purge flow, and to permit shut-off to prevent the waste of fresh water during a serious fire.

### *Flushing the System*

All sprinkler and hydrant piping which has contained salt water should be thoroughly flushed after a fire or operation test. Sprinkler laterals should be provided with valves or plugs at dead ends in order that a flow of fresh water may be obtained throughout the entire system. The control valve should be "exercised" on a planned maintenance schedule to ensure its dependability when the emergency arises. One of the advantages of installing hydrants on the fresh-salt water piping is the convenience afforded for opening the system for tests and observation.

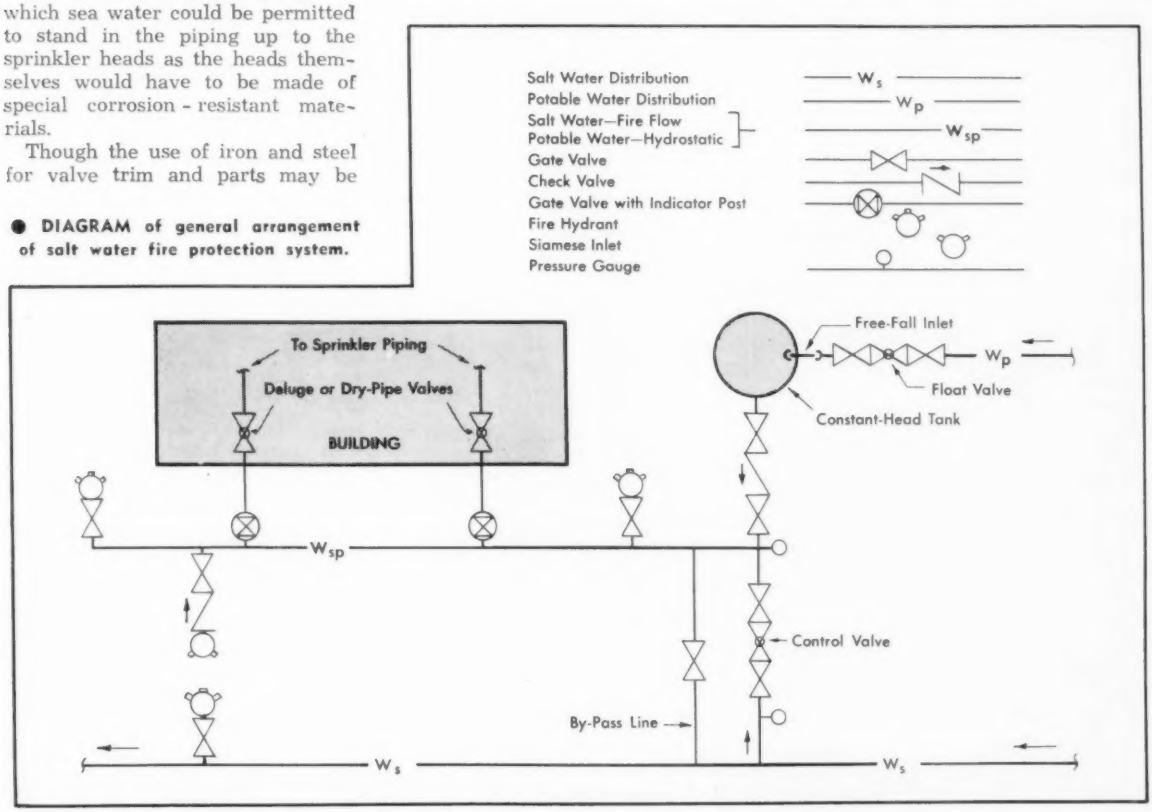
This design permits the use of standard materials for much of the piping; most of the valves and hydrants; and all of the piping, deluge valves and heads of the sprinkler system. There is no practicable design for sprinkler systems with closed or thermostatic heads in which sea water could be permitted to stand in the piping up to the sprinkler heads as the heads themselves would have to be made of special corrosion-resistant materials.

Though the use of iron and steel for valve trim and parts may be entirely satisfactory in some sea water installations, their behavior is largely unpredictable. Deterioration and failure may be quite rapid, with resulting increase in maintenance and sacrifice in dependability. Concrete, asbestos-cement, cement-lined cast iron and cement-lined steel pipe are the preferred materials for sea water piping because of their resistance to corrosion. Ni-resist cast iron is not susceptible to graphitic corrosion and possesses considerable over-all resistance to sea water attack. Copper and brass, and copper and nickel alloys are the most useful of all sea water materials for general service applications. They are, however, of limited use when incorporated in systems in which the sea water may flow at high velocity and subject the material to impingement corrosion, stripping away the protective inner coating formed as a corrosion product.

In the search for suitable materials for marine condenser tubes, metallurgists have developed a copper-nickel alloy, cupro-nickel, which is highly resistant to impingement corrosion and which exhibits extraordinary durability in sea water applications. The cupro-nickels are available as castings for valve parts, trim and specialties where their initial high cost is justified by their long life and dependability. Consequently, the control valve and all of those check and gate valves which, of necessity, will be exposed continuously to sea water are, preferably, composed of this alloy. In a dual water supply the number of such valves is limited. Pumps should be all-bronze fitted and, to eliminate the possibility of corrosion resulting from leakage of current from the electric motor to the pump, an insulating coupling between pump and motor shafts should be employed. Cast iron fittings are satisfactory throughout the system because of their weight. Titanium is completely unaffected by sea water but its use in water works practice cannot be foreseen because of its present high cost and limited applications.

### *Intakes and Pumping*

The ocean intake and pumping station must be planned carefully for the local water conditions. The extremes of the tide are an important consideration. Ordinarily, the demands on the intake will not be great because fire protection requirements will dictate storage capacity sufficient for a fire flow of




● **DIAGRAM of general arrangement of salt water fire protection system.**

four or more hours duration, which will permit off-peak pumping and/or the replenishment of storage over a twenty-four hour period. Exposed intakes will be most suitable where the ocean is deep immediately off shore, while submerged intakes are indicated where the sea water must be withdrawn from a shallow and gently sloping bottom. Small submerged inlets may be simply one or more upturned tees with screened openings. The inlet velocity through each port or opening should be limited to about 0.5 fps. Coarse screens should be provided for ports or openings; and fine screens for excluding shellfish and debris should be placed at accessible locations in the pumping station.

Where an exposed intake is feasible, it and the pump house may be designed as a unit structure. Intake ports should be sufficient in number to limit the velocity of the incoming water to approximately 0.5 fps and they should be protected with trash racks and fine screens. The use of traveling screens will be justified in some installations. The dry type of pump house, in which the pumps are installed below the lowest water level, is preferred because of the convenience of operation, inspection and repair of the pumps. In the wet type of pump house the pumps are submerged in a well which receives the water from the intake. This construction is usually less costly than the dry pump house, permitting the installation of a ported wet wall surmounted by a wooden building housing the pump motors, control panel and chemical dosing apparatus.

In those locations where sheltered inlets or tidal estuaries are nonexistent or are remote from the facility which is to be provided with sea water it will be necessary to withdraw the water by means other than the more or less conventional intake. The quality of water desired, feasibility and cost will determine which one of the following methods for withdrawing the water shall be adopted.

1. A vertical well, or wells, drilled near the shore.
2. A radial collector, which consists of a concrete caisson located on the shore beyond the high tide and from which horizontal collection pipes extend seaward.
3. A well-point system.
4. An open-top concrete vault containing a header, or manifold, of perforated pipe and backfilled with gravel and rock after installation in a trench on a sandy beach . . . with due regard to low tide and the "head" required for flow.

Any of the above listed collection means will provide at least a partially filtered water, with the preference going to the radial collector for the quality of water yielded, though it is the most costly of the suggested methods.

### *Reservoir Construction*

Reinforced concrete is the preferred material for saline water distributing reservoirs. Prestressed tanks will usually prove to be less costly and more satisfactory than the conventional structure, in which the horizontal construction joints are often the source of annoying leaks. Elevated storage, equal to or greater than the maximum sprinkler-plus-hose stream demand, for one hour of flow, or the four hours of maximum hydrant demand, whichever is greater, is desirable. Seldom does the terrain afford suitable sites for the construction of concrete reservoirs at elevations great enough to impose the requisite static pressure on the system. However, an elevated steel storage tank can be prepared for saline water service by spraying cement on wire mesh welded, or otherwise affixed, to the tank interior.

It is difficult to provide corrosion resistance for the large diameter (four feet or more to prevent freezing) steel riser pipes of elevated sea water tanks because the riser is erected and welded in sections. Any continuity of interior lining thus could not be obtained unless the lining were applied after the riser is in place. It is best protected by cathodic means, preferably a full length anode supplied from a separate electrical circuit, if cathodic protection has been selected for the storage tank proper. Elevated tanks with a riser height of fifty feet or less erected in locations with mild climate may be equipped with a single length of standard size large diameter steel pipe, cement-lined, in place of the conventional large diameter riser, and no cathodic protection will be required. In freezing climates, this short riser, of cement-lined steel pipe, may be enclosed in the conventional riser and the annular space heated as necessary, by a thermostatically controlled steam, oil or gas-fired unit. Sea water begins to freeze at approximately 28° and, although it is not completely frozen even at —60°F., protection for the smaller riser pipes is a wise precaution in the more rigorous climates.

Filamentous growths and free-swimming algae-like organisms encountered in ocean waters can be controlled, in most cases, by continuous dosages of chlorine. In almost all applications, chlorine as an algicide is fully as effective as copper sulfate although it is used much less frequently, probably because copper sulfate can be applied with simple apparatus and with little difficulty to a large body of water, such as a reservoir. Chlorine is not so readily administered and it imparts an odor to the water in some instances. However, neither taste nor odor is an essential consideration in the design of sea water fire protection systems and chlorine is applied to water in pipe lines with ease. The problem is essentially one of determining the proper chemical dosage for preventive control of marine growth. The types of microorganisms that may be encountered and their activity will be peculiar to the climate of the installation. Unless local records of successful marine growth control in sea water pipelines are available, the engineer will have to determine the effective dosage of chlorine or other chemicals by careful observation supplemented with dissolved oxygen and free chlorine residual tests made at selected control points throughout the system. A 0.3 to 0.6 ppm free chlorine residual at these control points in the pipe network will probably be adequate and it may possibly be scaled downward. The system should be flushed frequently and, if after several years of operation, a period of heavy chlorine dosage followed by flushing reveals few slime tubercules issuing from fire hydrants it may be then assumed that all is going well in the aquatic growth battle.

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### Lagoons for Air Base Sewage Treatment

Sewage and wastes from the new air bases at Minot and Grand Forks, North Dakota, will be treated in sewage lagoons. To care for the changing population three lagoons of varying sizes will be used.

# TREATING SEPTIC TANK EFFLUENT *by an Oxidation Pond*

**H. K. GIDLEY,**
**Director,**
**Division of Sanitary Engineering**
**Charleston, W. Va.**

A BUILDING program was completed by the State of West Virginia in 1953 which added 100 beds to Denmar Sanitarium, a state institution maintained for the treatment of tuberculosis. When the appropriation was made to expand the institution to 240 beds, no provision was made for the enlargement and rehabilitation of an inadequate sewage treatment facility consisting of a septic tank, dosing siphon and a sub-surface filter trench. The effluent from this discharged into the Greenbrier River. Even without the added load from the new hospital beds, the sub-surface filter was functioning poorly and, for all practical purposes, the river was receiving septic tank effluent.

Greenbrier River is a fine mountain stream, and is extensively used during the summer months for fishing, boating and swimming. Numerous camps and summer cottages have been established along its banks. Although the minimum river flow is more than adequate for the dilution of the relatively small volume of sewage from Denmar Sanitarium, the State Health Department objected to the bacterial contamination of the river because of the stream's use for recreational purposes.

In view of the lack of money then available in the institution's budget, the writer suggested to the State Board of Control, the agency having jurisdiction over state institutions, that a sewage oxidation pond be provided on available land to treat the septic tank effluent. The Division of Sanitary Engineering agreed to prepare the plans, stake out the project and supervise construction: the only direct cost to the Board would be $1,500 for lagoon excavation and embankment and a connecting gravity sewer from the existing septic tank to the pond.

Conditions were ideal for an oxidation pond at Denmar. The institution is located on a bluff overlooking a broad level field adjoining the river. Sewage from the institution flows by gravity to the concrete septic tank (20,000-gallons capacity), which is located at an elevation well above and only 300 feet away from the pond site. An existing sewer was available to carry the pond overflow to the river.

The pond was designed for a maximum loading of 40 pounds of BOD per acre of water surface per day. Although this was thought to be a rather generous loading, it was recognized that the pond would function at its maximum efficiency during the recreational season and that a deteriorated effluent from November to April could be tolerated.

The pond is 360 feet long and 210 feet wide, and has a water depth below the overflow pipe of 3.0 feet. Based on a water area of 1.73 acres, an estimated BOD value of the septic tank effluent of 0.1 pound per person per day, and a capacity to assimilate 40 pounds of BOD per acre per day the pond will accommodate 1.73 x 40÷0.1 or 692 persons per day.

The pond was constructed in June, 1953, but was not filled with water and placed in service until May of the following year. The pond has functioned perfectly during the past year and a half. During a part of the period, there has been no flow from the pond, as evaporation and seepage have equalled inflow. In August, 1955, when the State Water Commission made a performance study of the pond, the water level was 3 ins. below the overflow outlet pipe.

Except for the heavy green algae growth which is visible upon close inspection, the body of water appears to be a normal farm pond. During the current summer, the pond has been the adopted home for a flock of wild ducks.

In August, 1955, the State Water Commission collected and composited over a 5:30 a.m. to 12:00 noon period samples of the raw sewage and the septic tank effluent as applied to the pond. A sample was also collected from the pond adjacent to the overflow pipe. The analytical results follow: Estimated flow per day was 30,000 gallons of

● **SEPTIC tank location, oxidation pond and buildings of Denmar Sanitarium are shown. The pond is designed for 40 lbs. of BOD per acre of water surface per day.**

raw sewage and septic tank effluent; BOD ppm was 172 ppm in raw sewage, 112 ppm in septic tank effluent and 8 ppm in the oxidation pond; coliform MPN per 100 ml was over 1,100,000 in the septic tank effluent and less than 300 in the oxidation pond; suspended solids were 172 ppm in the raw sewage, 135 ppm in septic tank effluent and 138 ppm in the oxidation pond; total solids were 805 ppm in the raw sewage, 488 in the septic tank effluent and 319 in the oxidation pond.

It is apparent from these analyses that the oxidation pond is providing excellent secondary treatment for the applied sewage load. Although the results represent only a single day of sampling, there is no reason to believe the pond water remains in excellent condition throughout the year. A second set of samples will be examined during the coming winter.

The above results indicate an applied load of 28 pounds of BOD per day to the pond, or 16.2 pounds of BOD per acre per day, which is only 40 percent of the design capacity. The septic tank was removing about 35 percent of the applied BOD and the oxidation pond was removing an additional 60 percent, giving an overall BOD reduction of 95 percent. The reduction of coliform organisms was over 99.97 percent.

The cost of the Denmar pond was about $1,500 including the cost of the excavation and embankment and the inlet and outlet piping. Although a fence would normally not be required, the institution installed a fence to ward off cattle from an adjoining field. Denmar Sanitarium appears to have a low cost, long lasting treatment device. Also, it seems likely that digested sludge from the septic tank could be drained into the pond intermittently in small quantities and eliminate the occasional cost of cleaning the septic tank.

Currently, the West Virginia Conservation Commission is planning on the stocking of the Denmar oxidation pond with blue gills and bass. This would be an experiment and there is no thought of making commercial or recreational use of the pond.

The farm manager at Denmar Sanitarium recently requested funds to provide a system for the supplemental irrigation of crops raised on the river bottom land adjoining the sewage lagoon. Water from the sewage oxidation pond should contain nitrogenous materials of some value, and some water would be available through gravity flow for irrigation as long as the pond level was not lowered excessively. Perhaps, it would be feasible to route the river water to be pumped for irrigation through the oxidation pond, thereby maintaining the pond level and at the same time applying to the soil any nutrients which may be in the sewage pond water.

Secondary treatment of septic tank effluent by oxidation ponds can be used successfully where location and topography permits an economical installation. The treatment appears to be well adapted to small installations involving a few hundred persons. The Denmar installation has not been loaded heavily enough to check the original design assumption of 400 persons per acre per day on a septic tank effluent strength of 0.1 pound BOD per person per day. A winter check has not been made to determine treatment efficiency during cold weather.

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### Effects of Asphalt on Soil Structure and Erodibility

Cut-back bitumen and an emulsion of bitumen in water have been tested for improving soil structure and controlling soil erosion by wind. Materials were applied as fine spray at rates up to 400 gal. per acre, on the basis of undiluted material, and furnished a film that was, initially, completely effective in holding various soils against wind. The finer the spray and the more dilute the solution the more uniform and stable was the film. The film was effective only for about 2 weeks on clay soil and for at least 2 months on sand and loamy sand. Rainwater was readily absorbed by the film which was generally porous. It was found that (1) bitumen mixed with soil produced a high degree of soil aggregation in both the wet and dry state and decreased wind erodibility but only for about 2 years, and (2) the treated soil became progressively more granulated and more erodible by wind but continued to have a substantial proportion of water-stable aggregates and to be much more permeable by water. The changes in the physical properties of the binder in soil and its relation to soil structure and erodibility have been recorded and explained, and it is concluded that bitumen when added to soil will be effective against erosion by wind only as long as its sticky property is maintained. Abstract from the Proceedings of Soil Scientists by Road Abstracts, Dept. of Scientific & Industrial Research, England.

## Lime and Fly Ash used for Shoulder Stabilization

Through a cooperative project involving the National Lime Association, Clarkson College and the New York State Highway Department, 1600 ft. of shoulder on SH 56 near Potsdam were stabilized with lime and fly ash. The soil of the shoulder section varied between a sandy silt (A-4) and a silty sand (A-2-4). Approximately 5 percent of high-calcium hydrated lime and 15 percent of fly ash were used to stabilize the shoulder section to a depth of 4 ins. Procedures involved scarifying and pulverizing, adding the stabilizing ingredients, mixing, wetting and compacting with a steel-wheel roller. Because of the medium large stones in the soil, a spring tooth harrow was used for mixing. The treated strip was 4 ft. wide. The project is being observed to determine its service under traffic, which is classed as moderate in volume with some heavy logging trucks. The road is two lanes wide.

● SPOTTING lime bags along the section of shoulder to be stabilized.

● MIXING lime and soil with a weighted tractor-drawn spring harrow.

● STORM WATER CULVERT installed under U. S. Route 95 at Walter Lake, Nevada, uses 36-inch corrugated metal pipe.

## HOW TO

# Design and Install Culverts

W. H. SPINDLER, Armco Drainage & Metal Products, Inc., Middletown, Ohio

ALTHOUGH culverts represent a relatively small portion of the cost of road construction (about 3 per cent), they are the first line of defense against costly damage. They need to be large, strong and durable enough to protect the roadway against overtopping, undermining, and premature failure. Good culverts, therefore, are a wise investment. The more important the road, the more liberal should be the design.

Surface water should be conducted across and away from a roadway as promptly as possible. Proper alignment, grade, and installation methods, as discussed in later paragraphs, are important in the adequacy of a culvert or cross drain. If a culvert silts up, pulls apart or washes out, it will not have the capacity nor give the service intended.

A culvert usually constricts the waterway, thereby causing some ponding of the water at the inlet and an increase in velocity inside and beyond the culvert. The outlet may need protection against scour and undermining.

Culverts should not be designed to flow full or with the headwater submerging the entrance oftener than once every twenty-five years. On minor, lightly traveled roads, overtopping of the roadway once in a few years may be of no consequence if the embankment is protected. For heavily traveled roads and on railroads, the size of the culvert opening should be such that, while submerging the entrance may occur on rare occasions, overtopping of the roadway will not occur at any time. There is an economic

This text is based, with some variations on "Handbook of Drainage & Construction Products", 1955 edition, edited by Mr. Spindler and published by Armco Drainage & Metal Products, Inc., Middletown, Ohio.

● **CULVERTS should not be designed to flow full oftener than every 25 yrs.**

relationship between (1) providing a large culvert opening; (2) repairing the roadway in case of overtopping; (3) maintenance of culvert and channel; (4) interference with heavy traffic; and (5) safety.

Fresh in the memory of many people is the tremendous flood damage following the hurricanes along the east coast and inland during the past few years. It is not economically feasible to design culverts against all such contingencies. However, it is well to design on the liberal side for size. If the culvert serves partly as a "fuse-plug", it may help to build it in such a way that it can be reclaimed.

### Waterway Requirements

Following are some of the points to consider in determining the waterway requirements of a culvert:

1. The shape, slope and land use of the drainage area affect the runoff.

2. The area of the watershed should be determined. Small areas can be estimated; larger ones measured or scaled from available maps.

3. A profile of the channel and a cross-section of the embankment at the culvert site are helpful in designing the culvert.

4. Other information should include high water levels, erosion resistance of the channel and the possibility of drift.

### How to Determine Size

There are three general methods in use for determining the required size of a culvert:

1. Inspection of the old structure at the site, or of structures up and downstream.

2. Use of an empirical formula to determine directly the size of opening required.

3. Use of a formula to determine the amount of water reaching the culvert, then a second formula to determine the size of culvert required to carry this amount of water.

1. *By Inspection*—One of the most practical ways of determining proper size is by inspection of an existing structure at the site (also upstream and downstream) even though its size may have been established by guess. Note the size and shape and the condition of the channel above and below. Was it adequate or oversize at peak flood-flow over a period of twenty-five years or more? Long-time local residents or maintenance men may have information as to high water marks and adequacy. Structures built during drought years may be inadequate later. Local residents may be concerned about keeping drainage openings on the liberal side and may testify accordingly.

2. *Talbot Formula* — Because of the simplicity in giving culvert size directly, the Talbot formula continues to be popular. It is an empirical formula that does not take into account the intensity of rainfall, velocity of flow or other rational factors:

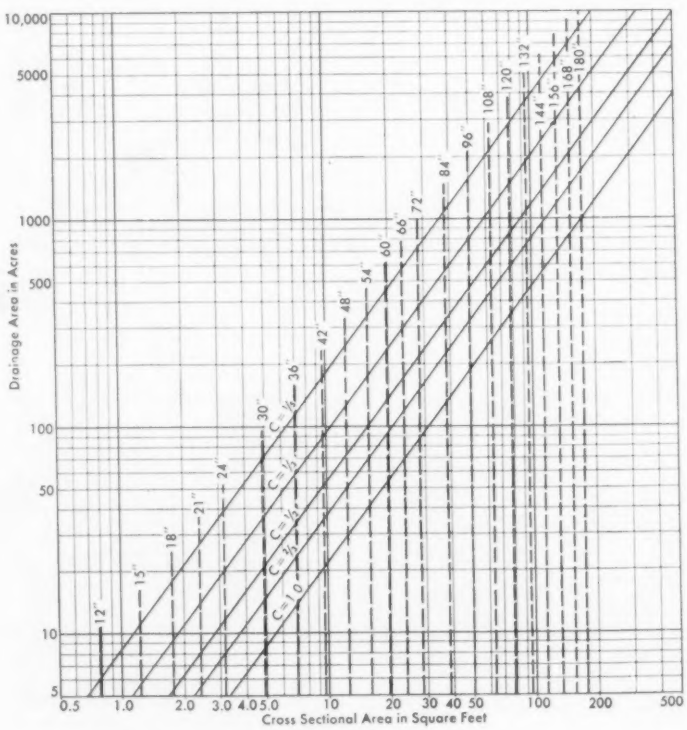
$$A = C\sqrt[4]{M^3}$$

where A = waterway necessary in sq. ft.
M = area drained in acres
C = coefficient

The coefficient C depends upon the contour of the land drained, and the following values are recommended for various conditions of typography.

- C = 1, for steep and rocky ground with abrupt slopes.
- C = 2/3, for rough hilly country of moderate slopes.
- C = 1/2, for uneven valleys, very wide as compared to length.
- C = 1/3, for rolling agricultural country where the length of valley is three or four times the width.
- C = 1/5, for level district not affected by accumulated snow or severe floods. For still milder conditions or for subdrained lands, decrease C as much as 50 percent; but increase C for steep side slopes or where the upper part of the valley has a much greater fall than the channel of the culvert.

*Example*: Required, the cross-sectional area of a culvert suitable for draining 75 acres in level coun-




● **FIG. 1. Diagram for the solution of the Talbot formula for culvert sizes.**

try. Assuming 1.5 as the value of C, locate the intersection of the 75-acre line with the first curve of Fig. 1, then trace directly down to the base line. This point lies almost exactly at 5 sq. ft. A 30-in. pipe is the nearest stock size.

3. *Jarvis-Myers Formula* — The Jarvis-Myers formula giving the peak discharge anticipated for various larger size drainage areas, is as follows:

$$Q = 10{,}000\ P\sqrt{M}$$

in which Q = total flow in cu. ft. per sec.
P = a coefficient, normally less than 1
M = the drainage area in sq. mi.

Since this formula gives the volume of flow anticipated, the second part of the problem is to select or design a culvert (or bridge) to carry the peak discharge within the limits set up for headwater elevation and outlet velocity. In general, this formula is primarily applicable to larger drainage areas. Few storms will exceed P = 0.25.

There are many other formulas giving widely varying results. The engineer must depend on his own experience and judgment in deciding which formula and what size structure to use.

### Modifying Conditions

*Free Outlet Condition.* The amount of water a culvert will carry is controlled by several things: the slope of the flow line and streambed above and below, the elevation of the headwater (at inlet), the type of inlet, roughness of culvert interior, and height of the tailwater or backwater.

If a culvert were the same size as the channel above and below, the design problem would be simple. However, a culvert is usually a constriction in the channel, and during flood flow the water will pond upstream from the culvert. If the culvert has a free discharge and sufficient slope, there will be a drop down of the water surface at the inlet; the velocity increases but the culvert does not run full. The minimum slope of the culvert that permits the maximum discharge of water is called the "critical slope."

● **CULVERTS should have a "free" outlet. Required sizes for free outlet conditions are determined by reference to Table 1 below which holds for pipe of any length.**

For slopes less than critical, the discharge may be less for a given level of water at the culvert inlet. Slopes steeper than critical will not increase the discharge for any type of culvert, regardless of friction unless it is made to run full by some artificial means. For such cases, the discharge is limited by the amount of water that can enter the pipe.

For culverts under this free outlet condition, the required size can be determined from Table 1. This table assumes a pipe of any length, with the headwater or pond at the crown elevation of the pipe. It gives values of discharge for various diameters and slopes. This table, prepared under the direction of Professor S. M. Woodward, formerly of

TABLE I CAPACITY OF CULVERTS WITH *FREE* OUTLET
WITH WATER SURFACE AT INLET SAME ELEVATION AS TOP OF PIPE, AND OUTLET UNSUBMERGED
Values are in cubic feet per second

| *Slope in Per Cent* | *Diameter of Pipe, in Inches* | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *8* | *10* | *12* | *15* | *18* | *21* | *24* | *30* | *36* | *42* | *48* | *54* | *60* | *66* | *72* | *78* | *84* | *90* | *96* | *108* | *120* |
| .1 | 0.2 | 0.4 | 0.6 | 1.3 | 2.1 | 3.3 | 4.7 | 8 | 12 | 20 | 25 | 36 | 47 | 67 | 85 | 110 | 130 | 160 | 190 | 270 | 330 |
| .2 | 0.3 | 0.6 | 1.0 | 2.0 | 3.1 | 4.7 | 6.8 | 12 | 19 | 30 | 42 | 57 | 77 | 100 | 130 | 160 | 190 | 230 | 270 | 380 | 500 |
| .3 | 0.4 | 0.8 | 1.3 | 2.4 | 3.9 | 5.9 | 8.3 | 15 | 25 | 37 | 53 | 72 | 97 | 120 | 150 | 190 | 230 | 280 | 330 | 450 | 600 |
| .4 | 0.5 | 0.9 | 1.5 | 2.8 | 4.4 | 6.8 | 9.5 | 17 | 28 | 42 | 62 | 83 | 110 | 140 | 180 | 220 | 270 | 320 | 380 | 510 | 670 |
| .5 | 0.6 | 1.0 | 1.7 | 3.0 | 4.9 | 7.5 | 10. | 19 | 31 | 46 | 68 | 90 | 120 | 150 | 190 | 240 | 290 | 340 | 410 | 560 | 730 |
| .6 | 0.6 | 1.1 | 1.9 | 3.3 | 5.4 | 8.1 | 11. | 21 | 33 | 50 | 72 | 97 | 130 | 160 | 210 | 250 | 300 | 360 | 430 | 580 | 770 |
| .8 | 0.8 | 1.2 | 2.1 | 3.7 | 6.1 | 9.0 | 13 | 23 | 37 | 55 | 77 | 100 | 140 | 180 | 220 | 270 | 320 | 390 | 460 | 620 | **810** |
| 1.0 | 0.8 | 1.4 | 2.3 | 4.0 | 6.5 | 9.6 | 14 | 24 | 39 | 57 | 80 | **110** | 140 | 180 | **230** | **280** | **330** | **400** | **470** | **630** | 810 |
| 1.2 | 0.8 | 1.5 | 2.4 | 4.3 | 6.8 | 10. | 14 | 25 | **40** | **59** | 82 | 110 | **150** | **190** | 230 | 280 | 330 | 400 | 470 | 630 | 810 |
| 1.4 | **0.9** | **1.6** | 2.5 | 4.4 | 7.0 | 10 | **15** | 25 | 40 | 59 | **83** | 110 | 150 | 190 | 230 | 280 | 330 | 400 | 470 | 630 | 810 |
| 1.6 | 0.9 | 1.6 | **2.6** | 4.5 | **7.1** | 10 | 15 | **26** | 40 | 59 | 83 | 110 | 150 | 190 | 230 | 280 | 330 | 400 | 470 | 630 | 810 |
| 1.8 | 0.9 | 1.6 | 2.6 | **4.6** | 7.1 | **11** | 15 | 26 | 40 | 59 | 83 | 110 | 150 | 190 | 230 | 280 | 330 | 400 | 470 | 630 | 810 |
| 2.0 | 0.9 | 1.6 | 2.6 | 4.6 | 7.1 | 11 | 15 | 26 | 40 | 59 | 83 | 110 | 150 | 190 | 230 | 280 | 330 | 400 | 470 | 630 | 810 |
| 2.2 | 0.9 | 1.6 | 2.6 | 4.6 | 7.1 | 11 | 15 | 26 | 40 | 59 | 83 | 110 | 150 | 190 | 230 | 280 | 330 | 400 | 470 | 630 | 810 |
| 2.4 | 0.9 | 1.6 | 2.6 | 4.6 | 7.1 | 11 | 15 | 26 | 40 | 59 | 83 | 110 | 150 | 190 | 230 | 280 | 330 | 400 | 470 | 630 | 810 |

Note: The values in bold face type indicate discharge at the approximate "critical slope," when $n = .021$. Steeper slopes than "critical" do not result in increased discharge.

The "stairs" of heavy horizontal lines indicate approximate velocities of 2, 4, 6, 8 and 10 feet per second.

● **JACKING a culvert under three-lane concrete highway between Canyon and Amarillo, Texas. Pipe arch used here gives needed area within restricted head room.**

the University of Iowa, is based on the hydraulic theory of backwater and critical flow.

*Example*: Assume that the runoff has been computed to be 40.3 cfs. Assume the slope of the streambed at this location is 1.0 percent, and the outlet will be "free." What size pipe is required to pass this amount of water safely?

*Answer*: From Table 1 it will be seen that a 36-in. culvert will carry 39 cfs. and a 42-in. culvert will carry 57 cfs. The 42-in. size should be chosen because it gives a factor of safety over and above the required capacity.

*Submerged Outlet.* In level country or other cases where the water does not have a quick getaway, as when obstructed by flood water, the outlet of the culvert may be submerged. In this case the culvert may run full, and when this is true, the required size of culvert can be determined from Table 2.

This table is based on experiments only on the 12, 24 and 30-in. sizes, so the other values, especially in the larger sizes, are subject to error; also, this table is based on a length of 30.6 ft. only.

*Example*: Assume as in the above problem that the runoff is 40.3 cfs.; the streambed at this location has a slope of 1.0 percent; and the outlet is "submerged," with the water at the inlet just 0.4 ft. higher than at the outlet.

*Answer*: The slope of the streambed and the culvert has no effect on the capacity of the pipe, the "head" being the controlling factor. In column 1 of Table 2 will be found a head of 0.4 ft. Reading to the right, we find that a 42-in. pipe has a capacity of 35.4 cfs., but a 48-in. pipe has a capacity of 48.2 cfs. The 48-in. pipe allows a factor of safety and consequently should be chosen. It will be seen that a slight variation in head gives an appreciable variation in capacity; and since the head cannot always be determined accurately in advance, it pays to be conservative and allow a sufficient factor of safety.

*Effect of Inlet on Capacity.* Experiments show that flared types of inlets are more efficient hydraulically than are straight headwalls, square edge entrances and entrances where the culvert projects out into the inlet pond. In other words, a flared entrance admits more water into a culvert with a free outlet and consequently increases its capacity.

The actual amount of benefit from a flared entrance is variable,

TABLE 2 CAPACITY OF CORRUGATED METAL PIPE WITH *SUBMERGED* OUTLET CULVERT FLOWING FULL—STRAIGHT ENDWALL ENTRANCE
CULVERT LENGTH 30.6 FEET
Values are in cubic feet per second

| *Head on Pipe in Feet* | *Diameter of Pipe* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *12 inch* | **15 inch* | *18 inch* | **21 inch* | *24 inch* | *30 inch* | **36 inch* | **42 inch* | **48 inch* |
| .01 | 0.31 | .52 | .79 | 1.13 | 1.54 | 2.57 | 3.92 | 5.60 | 7.62 |
| .02 | .44 | .73 | 1.12 | 1.60 | 2.17 | 3.64 | 5.55 | 7.92 | 10.8 |
| .03 | .54 | .90 | 1.37 | 1.96 | 2.66 | 4.46 | 6.79 | 9.70 | 13.2 |
| .04 | .62 | 1.04 | 1.58 | 2.26 | 3.07 | 5.15 | 7.84 | 11.2 | 15.2 |
| .05 | .69 | 1.16 | 1.77 | 2.52 | 3.44 | 5.76 | 8.77 | 12.5 | 17.0 |
| .06 | .76 | 1.27 | 1.94 | 2.77 | 3.76 | 6.30 | 9.61 | 13.7 | 18.7 |
| .07 | .82 | 1.37 | 2.09 | 2.99 | 4.07 | 6.82 | 10.4 | 14.8 | 20.2 |
| .08 | .88 | 1.47 | 2.24 | 3.19 | 4.35 | 7.28 | 11.1 | 15.8 | 21.5 |
| .09 | .93 | 1.56 | 2.38 | 3.39 | 4.61 | 7.72 | 11.8 | 16.8 | 22.9 |
| .1 | .98 | 1.64 | **2.50** | **3.57** | **4.86** | **8.14** | **12.4** | **17.7** | **24.1** |
| **.2** | **1.39** | **2.32** | 3.54 | 5.05 | 6.87 | 11.5 | 17.5 | 25.0 | 34.1 |
| .3 | 1.70 | 2.84 | 4.33 | 6.18 | 8.42 | 14.1 | 21.5 | 30.7 | 41.8 |
| .4 | 1.96 | 3.28 | 5.00 | 7.14 | 9.72 | 16.3 | 24.8 | **35.4** | **48.2** |
| .5 | 2.19 | 3.67 | 5.59 | 7.98 | 10.9 | **18.2** | **27.7** | 39.6 | 53.9 |
| .6 | 2.40 | 4.02 | 6.13 | 8.75 | **11.9** | 19.9 | 30.4 | 43.4 | 59.1 |
| .7 | 2.59 | 4.34 | **6.62** | **9.45** | 12.9 | 21.5 | 32.8 | 46.9 | 63.8 |
| .8 | 2.77 | **4.64** | 7.07 | 10.1 | 13.8 | 23.0 | 35.1 | 50.1 | 68.2 |
| .9 | 2.94 | 4.92 | 7.51 | 10.7 | 14.6 | 24.4 | 37.2 | 53.1 | **72.3** |
| **1.0** | **3.10** | 5.19 | 7.91 | 11.3 | 15.4 | 25.7 | **39.2** | **56.0** | 76.2 |
| 1.2 | 3.40 | 5.69 | 8.66 | 12.4 | 16.8 | **28.2** | 43.0 | 61.3 | 83.5 |
| 1.4 | 3.67 | 6.14 | 9.36 | 13.4 | **18.2** | 30.5 | 46.4 | 66.3 | 90.2 |
| 1.6 | 3.92 | 6.57 | 10.00 | **14.3** | 19.4 | 32.6 | 49.6 | 70.8 | 96.4 |
| 1.8 | 4.16 | 6.96 | **10.60** | 15.2 | 20.6 | 34.5 | 52.6 | 75.1 | 102.0 |
| 2.0 | 4.38 | **7.34** | 11.20 | 16.0 | 21.7 | 36.4 | 55.5 | 79.2 | 108 |
| **2.2** | **4.60** | 7.70 | 11.74 | 16.8 | 22.8 | 38.2 | 58.2 | 83.1 | 113 |
| 2.4 | 4.80 | 8.04 | 12.25 | 17.5 | 23.8 | 39.9 | 60.8 | 86.8 | 118 |
| 2.6 | 5.00 | 8.37 | 12.81 | 18.2 | 24.8 | 41.7 | 63.0 | 90.3 | 123 |
| 2.8 | 5.19 | 8.69 | 13.24 | 18.9 | 25.7 | 43.1 | 65.6 | 93.7 | 128 |
| 3.0 | 5.37 | 8.99 | 13.70 | 19.6 | 26.6 | 44.6 | 67.9 | 97.0 | 132 |
| 3.2 | 5.55 | 9.29 | 14.26 | 20.2 | 27.5 | 46.1 | 70.2 | 100.2 | 136 |
| 3.4 | 5.72 | 9.57 | 14.60 | 20.8 | 28.4 | 47.5 | 72.3 | 103.5 | 141 |
| 3.5 | 5.80 | 9.71 | 14.80 | 21.1 | 28.8 | 48.2 | 73.4 | 105.0 | 143 |

Note: This table is based on the formula $Q = 3.10\ D^{2.31}\ H^{0.50}$ for corrugated pipe in which $Q$ = discharge in cu ft per sec. $D$ = diameter of pipe in ft and $H$ = head on pipe in ft = difference in elevation of water surface at inlet and outlet ends.

*No experiments made on these sizes—Quantity computed by formula.

This capacity table is compiled from figures obtained through a series of tests made by the Bureau of Public Roads at the Hydraulic Testing Plant of the University of Iowa. Note that capacities are for 30.6-ft lengths of pipe.

The figures in bold face type are for velocities of approx. 2, 4 and 6 ft per second, reading downwards.

depending on its actual shape and conditions prevalent at this point. Various tests have been made for individual conditions, and inlet losses are usually expressed in terms of velocity head. Flared types may be as low as 0.1 of the velocity head loss, whereas projecting sharp entrances may be several times higher.

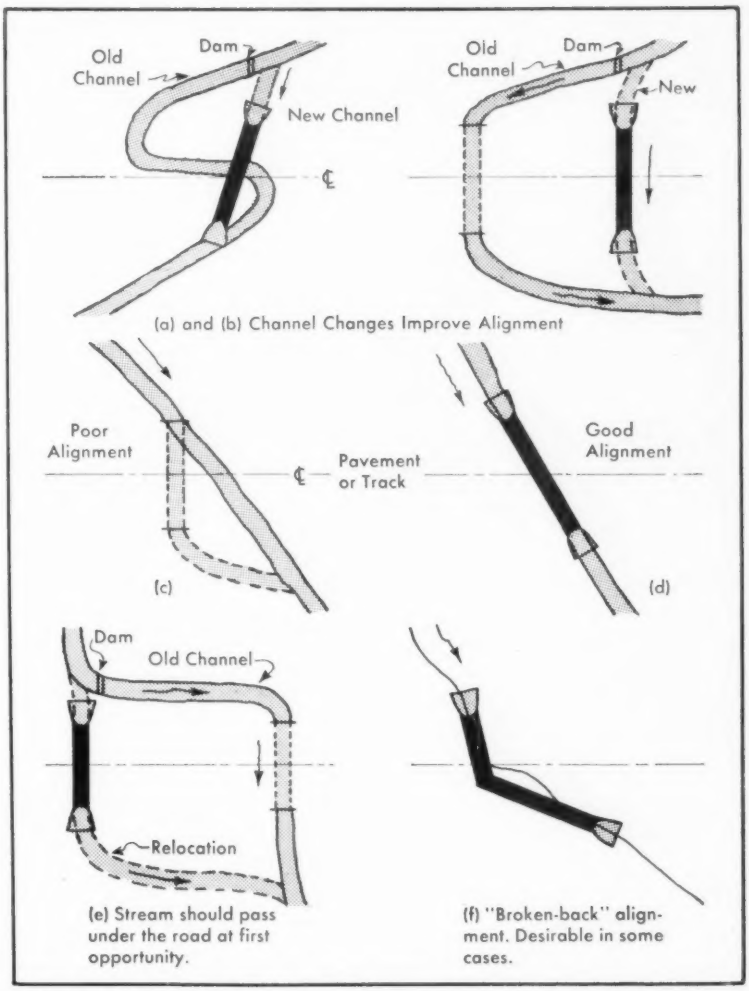
*A drop inlet* may be used where the culvert is to serve a soil-saving dam, or where the difference in elevation at inlet and outlet justifies some protection against high outlet velocities. Drop-inlet culverts normally require considerably larger sizes than are shown by the Talbot formula. The vertical or sloping drop-inlet is usually made the same size as the flatter portion of the culvert.

*Multiple Openings.* A single culvert opening is generally the most satisfactory because it offers least obstruction to flow and to drift. However, if the use of a single opening causes undesirable ponding of the flood plain upstream, the solution may be a low multiple opening, as shown in Fig. 2.

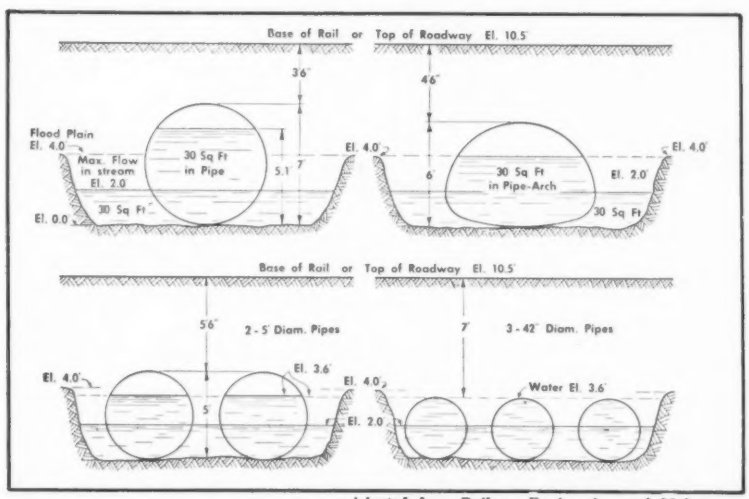
### *Where to Place the Culvert*

A culvert is an enclosed channel serving as a continuation of an open stream where that stream meets a roadway or other barrier. Consideration needs to be given to abutting property as to ponding upstream and to velocities downstream that will avoid undue scour or silting.

*Alinement.* The first principle of culvert location is to give the stream a direct entrance and a direct exit.




● **FIG. 3. Various methods of securing correct culvert alinement. A change in the channel may prevent the stream from changing its course near the culvert end.**




Adapted from Railway Engineering and Maintenance

● **FIG. 2. Here are four methods of obtaining required culvert opening, depending on head room available. For assumed conditions a single large pipe will cause water to back up and flood adjacent land. Twin or triple openings offer best solution.**

Any abrupt change in direction at either end will retard the flow and make a larger structure necessary. A direct inlet and outlet, if not already existent, can be obtained in one of three ways—by means of a channel change, a skewed alinement, or both. The cost of a channel change may be partly offset by a saving in culvert length or decrease in size. A skewed alinement requires a greater length of culvert but is usually justified by improving the hydraulic condition and the safety of the roadbed above the culvert.

The second principle of culvert location is to use reasonable precautions to prevent the stream from changing its course near the ends of the culvert. Otherwise the culvert may become inadequate, cause excessive ponding, and possibly wash out or require expensive maintenance of the roadway. Riprap,

sod, paving or metal end sections will help protect the banks from eroding and changing the channel.

Culvert alinement may also be influenced by choice of a grade line. Methods of selecting proper alinement are illustrated in Fig. 3.

### Culvert Grade Line

The ideal grade line for a culvert is one that produces neither silting nor excessive velocities and scour, one that gives the shortest length and one that makes replacement simplest.

Velocities as great as 10 ft. per second cause destructive scour downstream and to the culvert structure itself unless protected. Safe streambed velocities depend upon streambed materials and may range from 1.5 fps for colloidal fine sands and non-colloidal clays to 5.0 fps for cobbles. The silt carrying capacity of a stream varies as the square of the velocity.

A slope of 1 to 2 percent is advisable to give a gradient equal to or greater than the critical slope, provided the velocity is permissible. In general, a minimum slope of 0.5 ft. in 100 ft. is recommended to avoid sedimentation. Ordinary practice is to make the grade line coincide with the existing streambed. However, deviation is permissible if for a good purpose, as follows:

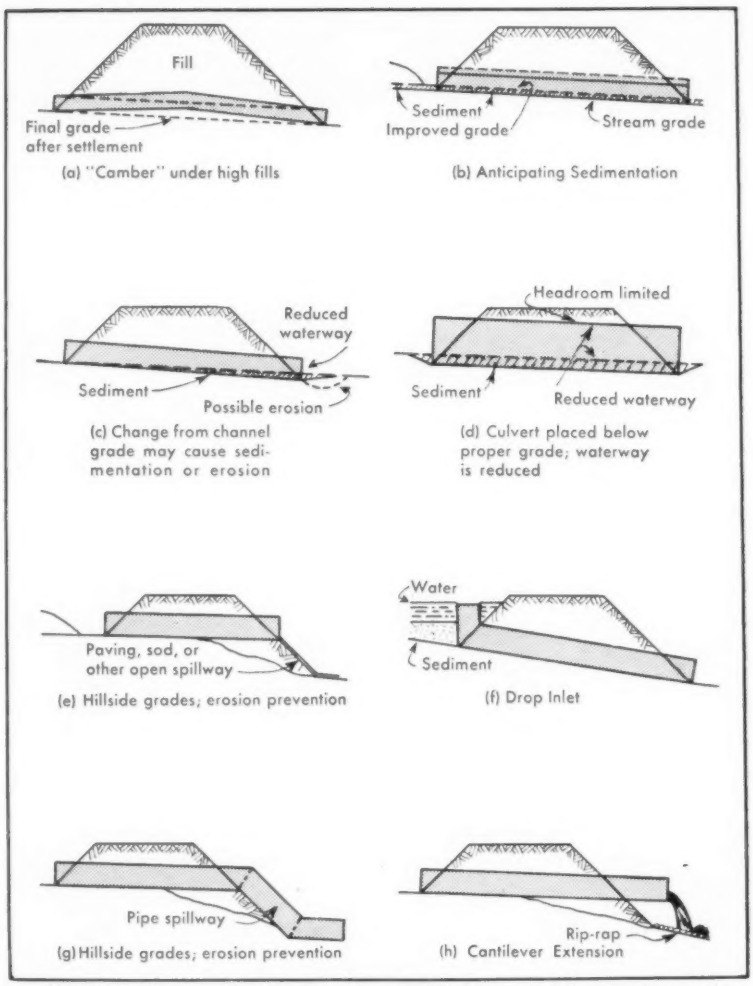
1. In freshly graded areas, on relatively flat gradients, expect sedimentation to occur. Set the culvert invert several inches higher than the streambed, but on the same slope (see Fig. 4b).

2. Where headroom is limited, setting a culvert below streambed grade is likely to result in sedimentation and reduced waterway area. Either use a low, wide culvert such as pipe-arch or raise the road grade.

3. Under high fills, anticipate greater settlement of the culvert under the center than at the sides of the fill. Give the culvert camber by laying the upstream half nearly level and putting all the fall in the downstream half.

4. Under high fills, it may not be necessary to place the culvert at streambed level. If some ponding is permissible, the culvert can sometimes be placed in firm ground at a higher level, thus reducing the length and simplifying replacement, should that ever be necessary.

5. In steeply sloping areas, as on hillsides, it is not always necessary to place the culvert on the same steep grade. The culvert can be put on the "critical" slope and then a spillway or cutoff wall provided at the outlet to prevent undermining.




● **FIG. 4. Proper culvert grades are essential; here are eight ways to get them. In general, a slope of 1 to 2 percent is advisable; minimum should be 0.5 percent.**

This keeps the culvert shorter and under shallower cover.

6. On steep slopes, it is also possible to use a broken-back grade line under the fill, although this is less desirable. (See Figs. 4f and 4g). Or a drop inlet or catchbasin will give the culvert a suitable slope.

### Culvert Length

The required length of a culvert depends on the width of the roadway or roadbed, the height of fill, the slope of the embankment, the slope and skew of the culvert, and the type of end finish such as end section, headwall, beveled end, drop inlet or spillway. A culvert should be amply long so that the ends are not clogged up by sediment or covered over by a settling, spreading embankment. This results in impaired efficiency and increased maintenance. On the other hand, a culvert should not have the ends wastefully exposed.

A cross-sectional sketch of the embankment and a profile of the streambed are perhaps the best means of determining the length of culvert needed. In the absence of such a sketch, the length of a simple culvert under an embankment can be determined as follows: To the width of the roadway (and shoulders), add twice the slope ratio times the height of fill at the center of the road. The height of fill should be measured to the flow line if headwalls are not to be used, and to the top of the culvert if headwalls or end sections are to be installed.

*Example*: A roadway is 40 ft. wide on top, with two to one side slopes, and at the center of the road the height of fill to flow line is 7 ft. The length at flow line is $40 + (4 \times 7) = 68$ ft.

If the culvert is on a slope of 5 percent or more, it may be advisable to compute the sloped length. How-

ever, fill slopes usually vary from the established grade stakes so that any refinement in computing culvert length may not be necessary.

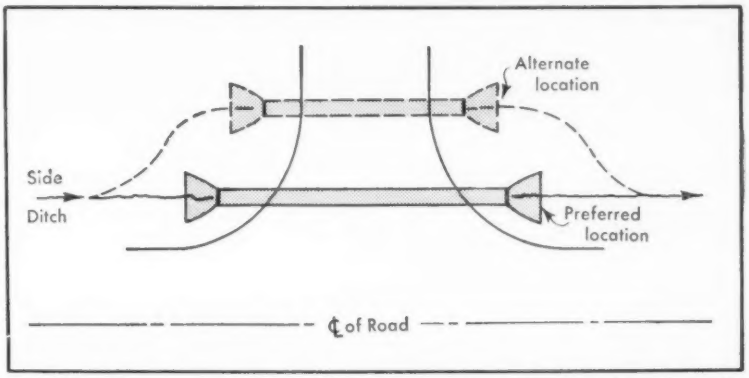
*Skew Angles*—Where a culvert crosses the roadway at other than a right angle, the skewed length should be computed. (Multiply the normal length by the cosecant of the skew angle).

The ends of the structure may be cut to make them parallel to the center line of the road. For correct fabrication of corrugated metal culverts it is essential to specify the direction of flow as well as the angle of the skew. This is particularly true for pipes and pipe-arches with the invert paved, for structural plate pipe with heavier plates in the invert, for structural plate pipe-arches and for arches.

*Side Road Culverts*—Side road culverts and culverts at farm entrances and in residential areas where side ditches serve instead of curb and gutters, should be placed in the nominal ditch line. They should be amply long to permit an easy turn onto or off the main road. In many locations where the quantity and velocity of water is small, the culvert may be set back from the ditch line and a shorter length be used. (see Fig. 5).

Where good appearance is essential or where a side ditch is hazardous, enclosing the entire ditch in a pipe may cost but little more and be much more satisfactory than a short culvert or intermittent culverts.

*Paved Fords*—On light-traffic roads and where overflow is infrequent, it is possible to economize on bridges and large culverts by permitting the flood waters to pass directly over a depression in the road. A single or multiple pipe or pipe-arch culvert will handle all water except occasional flood flows. To prevent washout the embankment must be paved or the roadway protected by means of sheeting or buried steel bin-walls.




● **FIG. 5. Entrance culverts should be long enough to allow a good turning radius and preferably should continue the straight alinement of the roadside ditch as shown.**

### How to Install a Culvert

Careful installation pays good dividends. The culvert designer must presume that reasonable care will be taken in installation. Otherwise he must over-design and increase the cost of the structure.

Three important steps in installation are (1) preparation of the base, (2) assembly or building the structure and (3) back-filling.

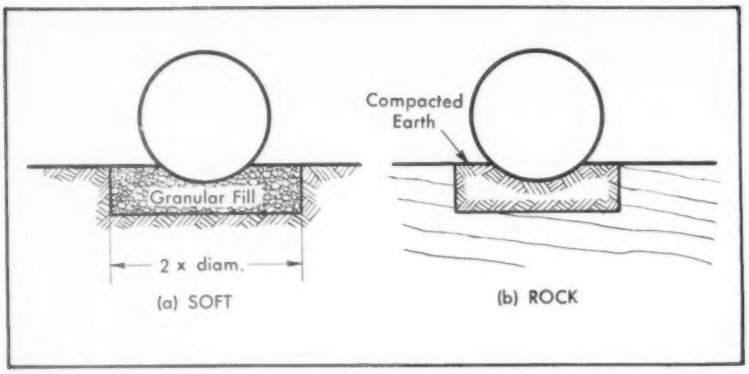
*Preparation of the Base*: If the structure is to be installed in a trench, the trench should be kept as narrow as possible but sufficiently wide to permit tamping under the haunches. Generally the trench width will not be less than 12 nor more than 24 in. greater than the outside diameter of the pipe structure. A wide trench requires more excavation and backfill and also tends to increase the load on the structure. Make the side walls as vertical as practical, at least to an elevation somewhat above the top of the pipe.

When installing the structure in a natural streambed, make sure the base is as uniform and stable as possible for the entire length of the structure. Often a small change in location can improve foundation conditions without affecting the flow. Frequently it will be necessary to stabilize the foundation as described in the second following section.

*Uniform Foundation*—All pipe and pipe-arch structures should be placed on a stable earth or fine granular foundation. Never install them on sod, frozen earth or on a bed which contains boulders or rock. When granular materials are used for bedding, the fill at the ends of the structure should be sealed against the infiltration of water. This often can be done by bedding the ends in well tamped clay or by using some type of head wall or end section.

*Unstable Foundation Soils*—When the excavated grade line for the structure crosses both soft and hard spots, the foundation should be made as uniform as practical. Sometimes, the hard spots can be excavated below grade and replaced with softer material. But more often, the soft spots need stabilizing with granular material. Excavating the foundation slightly below the grade line and backfilling with earth shaped to camber the flow line will often cure uneven conditions. In any event, abrupt changes from hard to soft foundation should be avoided.

● **FLARED entrance and flared outlet both contribute to the ability of the culvert to carry more water. Benefit derived depends on actual conditions at this point.**




● **FIG. 6. Unstable foundation material should be replaced, left; when rock is encountered, the pipe should be bedded on at least 8 inches of compacted earth.**

When soft, unstable material occurs at the foundation level, it should be excavated below the flow line grade and backfilled with sand, gravel, crushed stone or other suitable material. Make the width of the base at least twice the diameter of the pipe and as deep as the foundation conditions require. Fig. 6

If the unstable material is in small pockets, it is best to excavate all of the bad foundation and replace it with suitable backfill. Frequently a relatively thin mat (6 to 12 in.) of granular material, well graded, will provide a satisfactory support, but it may be necessary to replace the foundation to a depth of 3 ft. if it is very soft. Diameter of pipe and height of fill are controlling factors.

### Ground Factors

In swampy locations, especially along shore lines or adjacent to large rivers, deep unstable foundations are frequently encountered. If they cannot be readily stabilized with granular material, brush or timber mats may be used to spread the load. Never place a pile bent or a concrete cradle in direct contact with a corrugated metal structure if the structure is to support a fill. The cradle or pipe support should be built with a flat top and covered with an earth cushion.. (See "Rock Foundations.") This permits the flexible structure to develop side support without concentrating the load at any point on the circumference of the pipe.

When placing large diameter culverts, particularly under high fills, it is often good practice to install perforated pipe subdrainage to prevent subsequent saturation of the foundation and the fill around the pipe. In hilly country, foundation damage from seepage zones in the slopes adjacent to the fill can also be controlled.

*Cambered Grade Line.* When a culvert is installed under a high fill on a uniformly unstable foundation, raise the elevation of the flow line through the center portion of the structure above its normal position to allow for subsidence when the fill is placed. This is called cambering. Generally enough camber can be obtained by using a flatter grade for the upstream half of the culvert than for the downstream half. The matter of camber must be one of judgment, but do not raise the center so high that water will be pocketed in the pipe. Under high fills the camber should be substantial, especially where foundation conditions are not of the best.

*Rock Foundations.* When rock is encountered in the foundation, it should be removed to at least 8 in. below the bottom of the structure and wide enough to avoid any possibility of the pipe resting on the rock. The excavated area is then backfilled with compacted earth to provide a cushion for the pipe. (See Fig. 6).

The depth of cushion placed under the pipe varies with the size of the structure and the height of fill. An 8 to 12-in. thickness is usually sufficient.

Rigid-type culverts require the foundation soil to be excavated to the shape of the lower quarter of the pipe. For flexible structures, this end can be attained by carefully tamping the soil under the haunches. Rigid-type culverts on soft foundations may require cradling for adequate support. Flexible culverts do not require this precaution and it is advised against.

### Assembling the Structure

Pipe culverts can sometimes be assembled on the bank or roadway and then be lifted into place. This is advantageous in wet locations.

Corrugated metal pipe is joined together with bolted couplings or bands. Care should be taken to keep dirt or gravel out from between the pipe and band so that the band fits snugly. Bituminous coated pipe may require the use of a lubricant to allow the band to slip around the pipe and to draw firmly into place, especially in cold weather. If provided with a bituminous pavement, the pipe should be turned so this pavement is centered on the bottom.

Rigid pipe culverts should have the individual sections fitted as tightly together as possible, and still leave space for a mortar or bituminous joint, inside and out. Care should be taken not to disturb the pipe until the joint has properly set or cured.

MULTI-PLATE or bolted plate structures are installed much the same as riveted metal culverts. Final tightening of bolts should wait until all plates are in place.

### Important Details

Metal culverts, 54-in. and larger, may or may not require "strutting" —to make the pipe elliptical vertically—depending on anticipated loading and the gage selected. Such strutting may in some cases be done at the plant; in other cases, on the job.

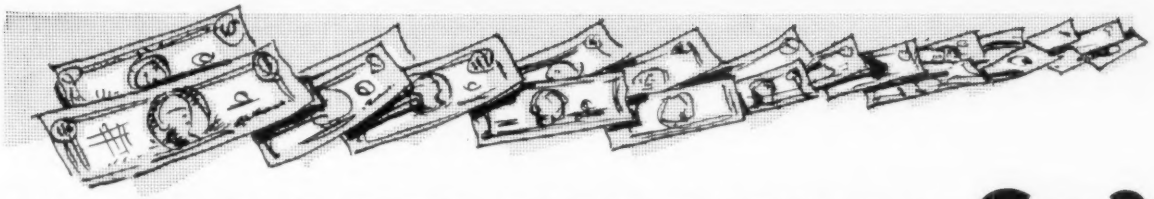
*Backfilling.* The importance of proper backfilling cannot be overemphasized. Flexible, metal culverts rely upon such backfill for a large share of their strength.

Selected, drainable backfill material is preferred but most local fill material can be used if carefully placed and compacted. It should be free from large rocks and hard lumps or clods larger than 3 in. in diameter. Materials to avoid include frozen soil, cinders, and earth containing a high percentage of vegetable matter.

Backfill should be placed to the top of the culvert in layers of about 6 in. and evenly on both sides. Compaction can be done by hand or mechanically. Puddling of the backfill is not recommended, especially in clayey soils, which become unstable.

Heavy construction equipment can damage a culvert during backfilling. So it is wise to avoid crossing the structure until sufficient protective cover is provided.

One final suggestion. If you know the purpose of the culvert, and the importance of the foundation and backfill, the chances are that you will get a satisfactory job at a reasonable cost.



# WHERE DOES THE MONEY GO?

## Film Tells TAX STORY

THE CITY COUNCIL of Phoenix, Ariz., obtained an invaluable public relations package at bargain basement prices with the completion in June of a new sound and color movie entitled "Phoenix — Your City." At a cost of only $5,000, Phoenix now has a 27-minute film suitable for showing on television, at civic club meetings, or at any gathering of people who are interested in the operation of their city and the cost of city services.

The Phoenix film is distinctive for several reasons: (1) It deals with only one central subject—where does the city's money come from and where does it go. It does not pretend to be a travel film or a chamber of commerce presentation. (2) It presents prosaic material dramatically. As one viewer put it, "you settle down to watch a section on the water department, when BANG, the fire trucks are roaring out and you're into the section on fire protection. It really holds your attention." (3) The film avoids picturing or naming any person in the present Phoenix city administration. In this way the film will be just as good five years from now as it is now, no matter how personnel changes. Moreover, no one can accuse the present administrators of spending public money to glorify themselves.

Believing that an informed public would be more likely to understand the city's problems, and act cooperatively instead of in an obstructive manner, the council voted in 1954 to produce an instructional film and show it to as many citizens as possible. One point they felt particularly important to put over to the Phoenix taxpayers: The general property tax provides only a small portion of the city's revenue—only 19 percent, on the average. In addition, they wanted to show Phoenix citizens how much they are getting for their property tax expenditure, and to inform them about the way in which various city departments operate.

● **SHOOTING the tax film story in downtown Phoenix. Bob Allen, shown here at work, did the photography.**

### *Film Format*

A Phoenix writer, Mrs. Dorothy Lawrence, was engaged to prepare a script and film companies were invited to submit bids on the photography and sound. Canyon Films of Phoenix, operated by Ray Boley and Bob Allen, was awarded the job for $5,000.

Mrs. Lawrence's script is built around the inquiries of a fictional newspaper editor into the Phoenix city government and services. The film opens with an aerial view of Phoenix, taken from a plane rapidly descending in altitude and flying north along the city's main north-south artery, Central Avenue. After the titles and credits, the scene moves to a building with a sign, "Phoenix Press," and then into the city editor's office.

First to speak is the editor. "I'm a newspaper man," he begins. "It's my job to report news. Here's a story that's factual, yet dramatic. It's your story because it's the story of your city. It's my business to know my city. It's your business to know what lies at the heart of your city. . . what pumps vitality into the life-lines of Phoenix, the growing, thriving Southwestern cosmopolitan center."

The scene then shifts to the Phoenix City Hall for a view of the city council in action. It's not the present council, but a group of men taking the parts of councilmen for purposes of the film. The editor shown in the earlier scene narrates this scene and later ones.

Following a brief explanation of the council's duties—and an invitation to all citizens to attend council meetings—the narrator starts his whirlwind tour of city departments.

### *What the Film Covers*

1. City manager's office: Explains that the city manager administers all departments and carries out the wishes of the council. It tells how the 1700 city employees are hired and the requirements they must meet.

● **IMPRESSIVE view of the motor equipment guarding the city was given by this view of police equipment. The Court House and the City Hall are in the background.**

2. Financial director: Shows pie chart indicating where the money came from to meet the city's $15,000,000 annual expenditure. These include shares in state and federal revenues, city privilege tax, parking meter money, service charges, fines and forfeitures, city owned utility income, airport income, and light and power franchises. Finally, the general property tax is shown to cover just 19 percent of the total revenue.

3. Police department: This opens with a parade of police vehicles and then shows a montage of various police activities. The audience is put onto the edges of their chairs by a shot of an automobile accident, after which police arrive to take over.

4. Traffic engineering: This explains why one-way streets have recently been instituted, how traffic lights cut accident totals, and how traffic controls are being installed to handle the rapid Phoenix growth.

5. Street department: Shows resurfacing operations, street widening, and shots of Phoenix's wide streets.

6. Sewer department: A man emerging from a manhole introduces the sewer section. Shots of the sewage disposal plant follow.

7. Garbage collection: Shows garbage trucks collecting garbage, another truck hauling away palm tree trimmings, and then the sanitary landfill.

8. Street cleaning: Power motor broom is shown cleaning a residential street.

9. Public health department: Food inspection, inspection of eating houses, and city clinics are shown. A nurse gives a baby a bath in a tub of water, and this bridged into the water department section.

10. Water department: From the tub of water, the scene shifts to the city's Squaw Peak water filter plant. Phoenix water supply sources are shown, and then a chart of Phoenix water demands in recent years.

11. Fire department: A fire blazes on the screen and a fire fighting company springs into action as the narrator describes the functions of the fire department. Shots of firemen in action are among the most interesting in the film.

12. City inspector: Men are shown checking plumbing and wiring installed in new buildings.

The final minutes of the film are devoted to a section which might be called "Phoenix at work and play." The camera shows people in business and industry, farmers, miners, and other workmen. It shows shopping centers, homes, churches, schools, and parks. Then it covers the city's outdoor sports, cultural activities, and special events such as rodeos, Indian ceremonials, and parades. The conclusion stresses the fact that city planning and maintenance helps provide the setting for these activities.

### *How It Was Filmed*

Only three professional actors were used in the film. All others were citizens who volunteered for special bits, or regular city employees, such as firemen, policemen, and street maintenance personnel. Scenes from the Phoenix Rodeo, spring baseball training of the New York Giants, and other special events were filmed as they happened. For the city departments, Canyon Films visited each department in order, spending four to five hours at each.

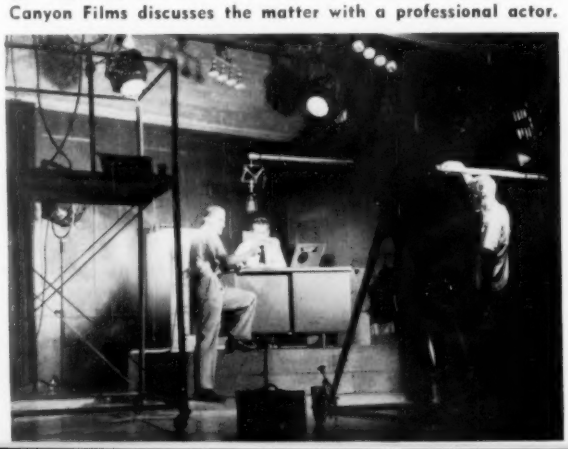
One of the secrets of the film's success in maintaining viewer interest is the fact that some ingenious continuity devices have been employed. The nurse bathing the baby leads to the water filter plant. The water department follows naturally. The man emerging from the manhole at the end of the street sequence brings on the sewer section. The water department ends with a fire hydrant, and then goes to the fire department sequence.

Bob Allen, who did the camera work, declared after the shooting was finished, "you know, I have a new respect for the city setup now that I've seen these people in action."

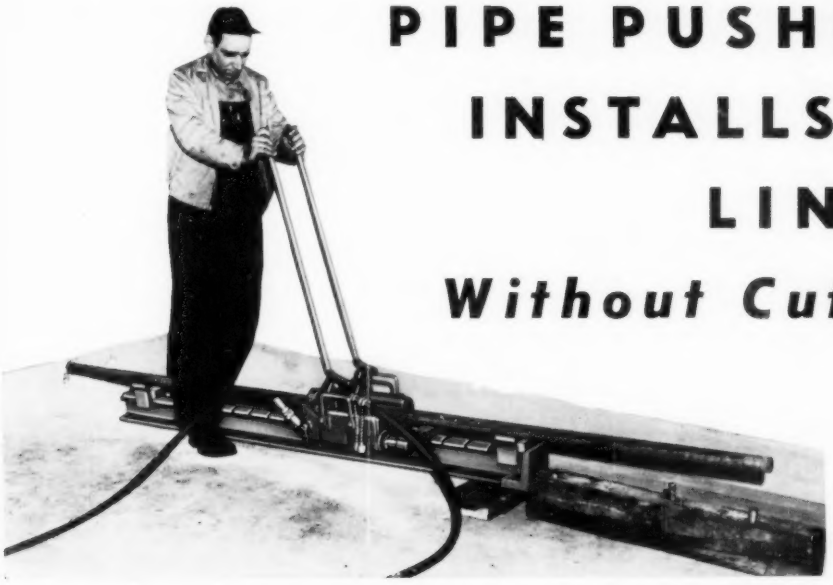
The Phoenix city council believes the film will inspire just such a reaction in all Phoenix citizens.

● **ONE OF the high-angle shots of downtown Phoenix which was used in preparing the film for educating the taxpayers.**

● **FILMING one of the scenes in the studio. Ray Boley of Canyon Films discusses the matter with a professional actor.**



# PIPE PUSHER INSTALLS SERVICE LINES *Without Cutting Lawns*



● **PUTTING in service lines with a minimum of trenching. Here the pipe pusher is shown at work in a basement. Power comes from the unit shown on the next page.**

WHEN a municipal water system is added to a community, contractors and home owners alike find there are a great many problems involved. The new city of Loves Park, Illinois, for years a rapidly growing unincorporated area, found out that the problem of installing copper water supply lines between the homes and street mains affects everyone. Since many of the homes had fine lawns and shrubs plus sidewalks and porches, any digging or trenching would pose an expense and inconvenience. While most sidewalks, driveways and porches could be tunneled under, some would settle or crack and have to be replaced. Every plumber and piping contractor concerned with this final step of the water supply hook-up wanted not only to do the job right, but also to leave the home owner with a lawn that was not torn up and with other property intact.

One of the contractors, Glenn Miner of Miners' Pump Service, busy with this municipal change-over, decided to investigate other methods of installing copper water supply lines. After checking into the methods which would eliminate much of the trenching usually required, Mr. Miner purchased a Greenlee No. 790 hydraulic pipe pusher.

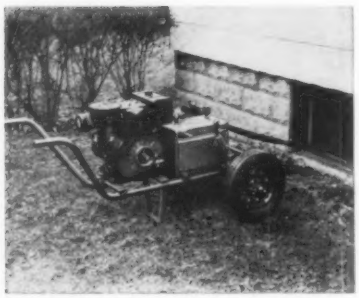
Digging a ditch at the curb connecting point was the only outside preparation required. This was accomplished by teaming a Henry hydraulic back-hoe and end loader with an Allis-Chalmers WD farm tractor. Because of its unique design, the Henry back-hoe could dig the sides of the ditch straight down. This type of digging meant that only a small area of lawn had to be disturbed and sidewalks and drives could be left intact. In cases where water or gas mains were encountered, the Henry back-hoe could dig around and underneath them. With the connection completed, the end loader and tractor were used to fill in the excavation.

On the first few jobs it was evident that the Greenlee pipe pusher would be the answer to the digging problem and its aftermath. Pipe could be pushed 40 to 50 feet from a basement, straight to the connecting point. Satisfied with the idea and operation of the pipe pusher to push pipe and pull in the copper supply line, Mr. Miner added a Greenlee power pump to speed up job completion and cut down on the manpower need for each job.

Setting up the pipe pusher and the hydraulic power pump from the time of arrival until ready for pushing, required less than one hour. This amount of time has proved to be about the same on every job done to date in Loves Park. Simplicity of set-up and actual operation were greatly appreciated.

After making an opening in the basement wall at the point where the pipe would go through, the pusher was set up. First the power unit was placed on the notched rail base and the pipe supports were put in position. Next the capped pipe was put on the pipe supports and the pipe clamp, against which the power unit exerts pushing pres-

● **COPPER tubing and pipe were connected in this ditch before pulling the tubing into position. An A-C tractor with Wagner backhoe and loader dug and filled trench.**



● **PUSHER in the basement was powered by this engine driven power pump.**

sure, was tightened around the pipe. In order to assure accurate pushing results, the complete unit was carefully blocked into position. Anchors placed in the floor secured the blocking for the backing plate. With the set-up completed, the pipe pusher was ready to operate.

Operation of the pusher, with power supplied by the power pump, can be controlled from either the pusher, as Mr. Miner did, or from the power pump for remote control. With the control lever on the power pump turned to the far left, the piston will move forward only when the injector lever handles are in a vertical or up position. The pistons move the pusher forward until the pawl at the rear of the power unit drops in the next notch. At this point the handles are pushed forward and down releasing the piston pressure to allow the tie block to move up another notch on the rail. In either method of operation this sequence continues until the pusher is at the end of the rail base at which time the pusher is moved to the back of the base. The pipe clamp is then positioned on another section of pipe and a new series of pushes started.

After the pipe had been pushed into place and coupled to the copper tubing, the direction of the action was reversed. The copper tubing was installed easily and without damage by simply turning the pusher around on its base, resetting the clamps, and pulling out the pipe. Very little time was required to complete this part of the job because the pipe had formed an oversized hole into which the copper tubing was pulled.

The hydraulic pipe pusher used here was designed for pushing pipe and rigid conduit sizes from ¾ to 4 in. inclusive. It has six pushing speeds to meet any soil condition. One-man operation is made possible by the Greenlee hydraulic power pump. In operation, the entire unit, consisting of a hydraulic pump and a 4½-hp. gasoline motor mounted on a pneumatic tired carriage, was wheeled up to one of the basement windows and connected to the pipe pusher by quick change hose couplings. On the water supply job shown in the accompanying photographs, the actual pushing and pulling time was just one hour. Coupled with a set-up time of one hour, this job, as well as most of the installations done by Mr. Miner, was completed in about two hours.

An interesting sidelight was provided by Mr. Miner with the check made on whether the pipe was being pushed straight or not. A checking device was made up by attaching a pen-lite to one end of a long steel tape and inserting the "lite" end into the pipe being pushed. If the entire light showed, the push was true, but if it veered off to the side and was cut off, the true course was not being held.

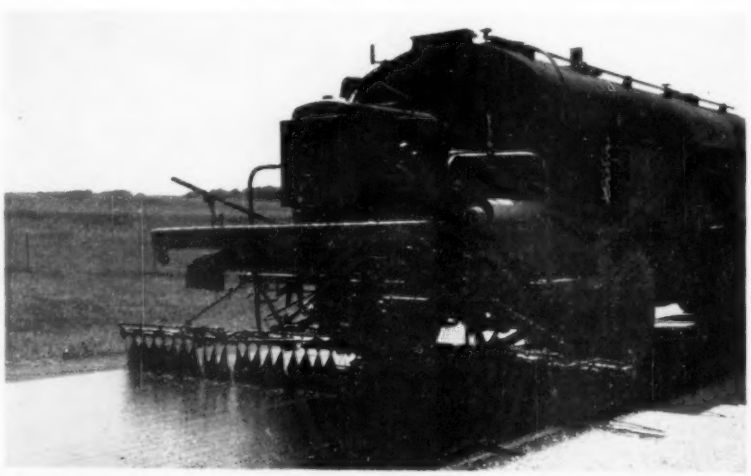
With little inconvenience to the home owners, the Loves Park water system was connected to each house. Landscaping and sidewalks were left intact. As a result, excellent public relations were maintained.

## Tests Conducted on Natural Rubber Asphalt Mixture

THE MINNESOTA State Highway Department recently put down a variety of rubber asphalt mixtures over some twelve miles of highway, about 15 miles outside of Monticello, Minnesota. One control section using RC5 in its natural state, and three rubberized sections using RC5 in conjunction with various rubber additives were laid. The natural rubber section, about three miles in length, consisted of an RC5 base asphaltic stock (85-100 pen.), 10 percent cutter and 2 percent natural rubber powder dissolved in the asphalt cement prior to the use of the cutter. While the viscosity of the RC5-natural rubber combination was slightly lower than that without rubber, the temperature used in laying both the non-rubber control and the natural rubber section was the same—275° F.

Use of the natural rubber occasioned no changes in the procedure, other than the blending of the rubber powder with the RC5 materials at the St. Paul Park refinery of the Northwestern Refining Company. The rubber and asphalt blended easily, and transportation from refinery to job site, and transportation from truck to distributor for application were routine operations. During the laying, the asphalt-rubberized mix flowed freely, with no clogging of nozzle or spreader bars. Due to rain just before the laying of the natural rubber strip, the stone chips were wet when placed. Despite this, whip-off was negligible. Actually, it was less apparent than during the laying of the non-rubber control section, which went down on dry stone.

Minnesota is considered an excellent testing ground for the weathering attributes of the natural rubber asphalt combination. Weather extremes experienced there should give good indications of rubber's ability to help counteract the effect of cold weather cracking and hot weather bleeding.



● **DISTRIBUTOR applies a coating of rubberized asphalt on Minnesota's Rt. 152.**

# *What you should know about* POISON IVY, POISON OAK and POISON SUMAC

● **TAKE CARE! Poison ivy, oak or sumac may be lurking in your path.**

DERMATITIS caused by contact with approximately 460 plants and woods has been reported in medical literature. Of these plants, poison ivy, oak and sumac are the most frequent offenders. Very few persons are capable of recognizing these common plants and there is considerable confusion regarding the contraction and treatment of these kinds of dermatitis.

The poisonous plants belong to the genus Rhus. They are Rhus toxicodendron, or poison ivy, Rhus diversiloba, or poison oak; and Rhus venenata, or poison sumac.

**Poison Ivy.**—This common plant is usually vinelike and climbs up trees and fences by aerial roots, but it may also be upright and shrubby. The leaves are pointed and oval, with a smooth and shiny, or slightly dull and hairy surface. They are usually about 3 inches long, the terminal leaf being longer than 2 lateral ones of the characteristic 3-leaflet group. Poison ivy flowers grow in small clusters and are greenish white in color. The fruit, in clusters similar to berries, is white or ivory in color. The foliage becomes red or orange in autumn.

**Poison Oak**—There are 2 types of poison oak; both are quite similar in appearance to poison ivy. The eastern variety differs from poison ivy in that the leaves have blunt tips and are hairy and more velvety. The fruit is also hairy and yellow-green in color.

The western variety of poison oak differs from poison ivy in that it may have 5-leaflet groups, as well as the characteristic 3-leaflet groups and both may occur on the same stem. The leaves are hairy and the foliage turns to brown and red when the fruit ripens.

**Poison Sumac** is a tall plant or small tree. The leaves consist of 7 to 13-leaflet groups, each leaf is 2 to 5 inches long and oval, smooth above and slightly hairy on the under surface. The leaves usually meet at the center of the stalk, much like the wings of an airplane. The small greenish flowers, borne in open clusters, are followed by fruit which is similar to that of poison ivy, but somewhat more flattened in shape. The stalk is often reddish in color; the foliage turns various shades of red in the autumn.

These plants are not only botanically related, but their methods of producing dermatitis are also similar. For simplicity, poison ivy alone is discussed. The active ingredient of poison ivy is a nonvolatile oleoresin—urushiol—which can retain its noxious activity in the laboratory after drying for a 5-year period. Urushiol is found in the leaves, flowers, fruit, bark and roots, but not in the wood, hair or pollen of the plant.

In general, plants may produce a dermatitis through 4 actions—primary irritation, cutaneous sensitization, photosensitization, and traumatic irritation. The active ingredient, acting as the primary irritant, produces an area of dermatitis localized only to the actual area of contact much in the same fashion as an acid or alkali burn. Acting as a cutaneous sensitizer, it will produce an area dermatitis extending beyond the area of actual contact because of a generalized allergic mechanism. A first exposure to the plants usually does not produce a dermatitis, but does produce a hypersensitization of the skin to the plant. A second or subsequent exposure is then capable of producing a dermatitis which spreads beyond the actual area of contact. Poison ivy, oak and sumac produce dermatitis through these two mechanisms.

Poison ivy, oak and sumac produce the same clinical picture, which may range from simple erythema or redness with itching or burning, to large blister formation with a tendency to lineal distribution. These symptoms may be associated with the more severe allergic phenomena such as hives or massive edema, especially of the soft parts. The course of the uncomplicated dermatitis is usually 5 to 7 days. Diagnosis is made by a history of exposure and an evaluation of the clinical picture. It may be confirmed in selected cases by

(*Continued on page* 163)

# NEW YORK PROVES····

# Anti-Litter Campaign

## *Can Be Effective!*

**ANDREW W. MULRAIN,**

**Commissioner, Department of Sanitation,**

**City of New York**

"A CLEANER CITY is up to you" is the slogan behind the intensive anti-litter campaign being waged by New York City to make New York one of the cleanest cities in the nation. Although the major reponsibility of the attack rests upon the Department of Sanitation, yet it is not standing alone as it has so often in the past in this all-out struggle. A task force committee headed by the Commissioner of Sanitation as Chairman and the City Administrator, Luther Gulick, as Executive Secretary, and numbering among its members the heads of twenty-eight City and other public agencies such as the Port of New York Authority, Tri-Borough Bridge Authority, Housing Authority, etc., is reinforcing the Department's forces. Another powerful ally is the Citizens' Committee for a Clean City, headed by Keith S. McHugh,

President of the New York Telephone Company. This committee is composed of public spirited citizens including top level executives of the business world. The present accelerated anti-litter campaign is the result of many months of thorough preparation by the Department of Sanitation. It is not intended to be a one-shot affair, but will continue uninterrupted until the objective of a practically litter-free city is reached and the last litter offender apprehended.

Considering the fact that New York has approximately 5,600 miles of streets which are used daily by a resident population of 8,000,000 in addition to 2,500,000 transients, one can easily see where the problem could reach staggering proportions. The Department has a total personnel complement of approximately 13,500; the 10,000 assigned to the functions of cleaning and collection amount to only one to every thousand persons in the city, resident and transient. The amount of pedestrian litter which could find its way to the streets if uncontrolled would make them all look like Broadway did after the MacArthur Parade when approximately 2,600 tons of litter were showered down.

After analyzing the situation, a two-fold strategy was devised to solve the problem.

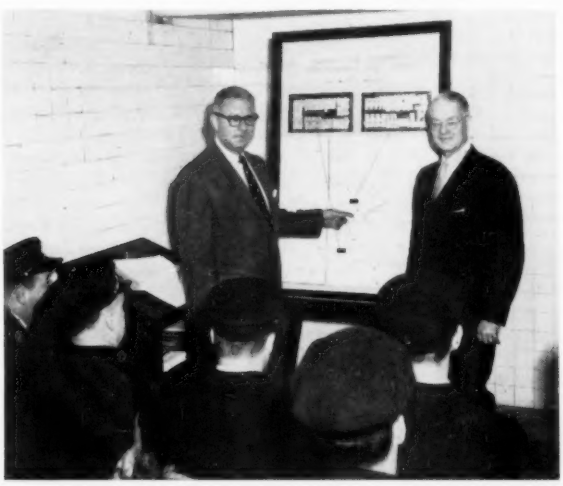
First and most important was the development of a program for securing public cooperation and the establishment of an enforcement agency having liaison with other City agencies to apprehend violators. Second was the deployment of the Department's personnel and equipment in the most effective and efficient manner to capture and collect that litter which did reach the streets.

The anti-litter campaign went into high gear in the early part of 1955. The steps of the campaign are being described in detail below so that they may be of guidance to other communities faced with this problem. This program, while geared to meet the needs of the City of New York and embarked upon on a scale dictated by the City's size, could very readily be tailored to smaller communities by scaling down.

● **CLEANING-UP: Sanitation men load discards during "Junk Collection Week."**

● **STARTING the Citizens' Committee Drive. Left to right, Comm'r. Mulrain, Mayor Wagner, Mr. McHugh, Mr. Larmon.**

● **IT COSTS money to litter New York now. Here the first of the 20,000 $25 fine signs are being posted prominently.**



● **PROCEDURES to be followed during the survey are outlined to City Departments by the Commissioner and Mr. Gulick.**

● **CLEAN-UP badges are being presented to school children in Brooklyn. A thousand schools were included in the program.**

The opening gun was fired by the Commissioner of Sanitation who pointed out to Mayor Robert Wagner that in spite of measures taken up to then and in spite of the utilization of the most modern sanitation equipment, methods and techniques known to the profession of municipal sanitation, the streets were still littered and many citizens were exhibiting a deplorable lack of civic pride. A request was made for Sanitation Patrolmen to enforce the Sanitary Code and apprehend violators. The same subject was discussed by the Commissioner before the Citizens' Budget Commission and again on the Citizens' Union Searchlight program on television and before representatives of the Commerce and Industry Group. All groups immediately volunteered their aid.

In response to the Commissioner's plea, the City administration authorized the appointment of 200 new Sanitation Patrolmen to assist in the anti-litter campaign. They were given an intensive three-week training course, starting February 21, 1955, at the Department of Sanitation Training Center in Brooklyn. They were a selected group of personnel taken from a civil service list of Assistant Foremen Eligibles. Most of them had more than five years with the Department and they had a working knowledge of the Sanitary Code and its practical application.

The course given consisted in reorientation, interpretation of the Sanitary Code, processing of affidavits, the issuance of summonses, court procedure, courtesy and public relations. After the classroom work was completed they were taken out into the field observing and inspecting litter conditions and receiving further training from experienced inspectors. An interesting item in this training was the holding of a mock court, presided over by one of the City Magistrates, to ac-

● **SANITATION students, the course fitting men to become Sanitary Patrolmen, are briefed by Commissioner Mulrain. Appointment of 200 patrolmen was authorized.**

quaint the new officers in the actual proceedings involving Sanitary Code offenders. The Sanitation Patrolman is smartly uniformed in deep blue, similar to that worn by the regular New York City Police force. Under the law he is empowered to issue summonses and, in extreme cases, to make arrests.

In order that there be no doubt in the offenders' minds of the penalty involved through littering the streets, 20,000 warning signs were affixed to lamp posts throughout the city. These signs were made of steel 18" x 24" in size; boldly lettered in red on a white background was the following legend "Littering Punishable by $25 fine." The first one was affixed by the Commissioner of Sanitation to a post in front of the main office and this received wide coverage from the press, radio and television. Included in the warning messages sent out by these communication media was the announcement that, beginning March 14th, the 200 new Sanitation Patrolmen would start serving summonses on offenders. On that date the patrolmen were graduated from the Training School after being addressed by Mayor Wagner, City Administrator Gulick and the Commissioner of Sanitation.

They promptly went to work and between March 15th and March 25th, 7,425 summonses were served. Their work was centered in 16 target areas which had been previously agreed upon as the most littered areas of the city. Besides the new men other personnel serve summonses as every one of the thousand Sanitation officers carries a summons book and is empowered to issue them to violators. Summonses were served primarily for violations of the Sanitary Code which relate to:

Littering of streets and sidewalks; dumping or throwing garbage, rubbish or waste into streets, areaways or vacant lots; neglecting to sweep sidewalks or sweeping rubbish into the streets; dropping waste from dirt carts or other vehicles; placing overfilled or uncovered garbage cans out for collection; placing loose paper or untied newspapers out for collection; and depositing garbage or household refuse in Department of Sanitation litter baskets.

### *Court Backing*

The courts backed up the campaign in striking fashion. The Chief Magistrate, presiding over the first 98 cases, levied a fine of $25 on each of the violators of the Code. During 1955, approximately 130,000 summonses were served for which fines aggregating $500,000 were imposed.

Besides enforcement of the Sanitary Code, the Department also concentrated on its function of providing the pedestrian with a place to get rid of litter. On May 23rd the Department embarked on a program of litter basket saturation in the heart of Manhattan using 3,000 new baskets that had just been delivered on a current contract. These baskets, equipped with signs bearing the legend "Littering is unlawful, drop litter here," were placed at intervals of about 100 feet along the curbs and at every curb intersection in an area that extended from 3rd Avenue to 8th Avenue and from 23rd Street up to 59th Street.

The Department has been using litter baskets for a number of years and has been experimenting in developing new types. The latest delivered are open type baskets with a general shape of a frustrum of a cone. The top diameter is 22 ins. tapering to a bottom diameter of 17½ ins. and a height of 34 ins. They are fabricated from 9-gauge expanded metal with ¾-in. openings with the vertical joint in the mesh compression welded. The top edging is formed of 16-gauge metal curled and securely lap welded and then fusion welded to the mesh at several points around the circumference. Additional intermediate reinforcing rings of ¼" x 1" steel bands are placed inside the basket at approximately 9 and 19 ins. from the top. The basket bottom is made of one-piece construction, pressed and turned out of 16-gauge steel, and the bottom 6-in. apron is made of 18-gauge metal. After fabrication the units are given an undercoat and a finished coat of aluminum paint. Each basket weighs approximately 54 pounds.

Several modifications have since been made. The mesh has been changed to ⅝-in. 9-gauge expanded metal in order to reduce the openings through which small pieces of paper could sift. Because of the greater structural strength of this mesh the intermediate rings are being omitted in this design. Hot-dip galvanizing is called for instead of two-coat painting as previously specified.

Field experiments are now being conducted with a basket fabricated from aluminum with the object of reducing weight and obviating the frequent painting required to keep the units looking presentable. In some of the locations, primarily along 5th Avenue, a fully enclosed metal container with a removable canvas bag is used. This type is suitable for special locations but does not lend itself to City-wide use because of additional emptying time.

Studies indicate that approximately 80,000 represents the optimum number of baskets required properly to service the city. As of the end of 1955 the Department had approximately 25,000 on hand, 2,000 on order and an allocation of the City's 1956 Capital Budget of funds to provide an additional 10,000. Baskets are obtained through competitive bidding based on the Department of Sanitation's own design. Damaged baskets are repaired in

the Department's shop with special tools designed by Sanitation personnel.

Usually baskets are emptied by the refuse collection crews on their regular routes although in some congested areas, as well as on Sundays, extra trucks are assigned to this special task. It is estimated that approximately 100 million pounds of material are deposited in the baskets annually, and that the average load is 25 pounds. Enforcement personnel are charged with the duty of seeing that the baskets are used properly. Some small business people, householders and occupants of rooming houses particularly have been apprehended depositing household refuse and trade waste in these baskets, thus defeating their purpose. Widespread publicity has been given to the notice that the baskets are to be used only for pedestrian litter, which includes such items as cigarette packages, candy and gum wrappers, newspapers and smaller light refuse; and that violations subject the offenders to fines up to $25.

One prolific source of litter in the past has been the bulky objects such as old furniture, boilers, bath tubs, old radios, bed springs, refrigerators, gas ranges and similar items which often surreptitiously found their way into the streets or vacant lots. In order to do away with even this source of litter, the week from May 23rd to May 28th was designated by the Commissioner of Sanitation as a "Junk Collection Week." All householders were informed by press, radio and television that any objects of this nature might be placed at the curb during this week and would be removed by the Department.

Special open-type trucks were added to the Department's regular collection fleet for the removal of objects too large to be handled by the regular collection vehicles. This service has now become a regular feature. Sanitation service bureaus have been set up in each borough so that householders may now telephone the local Department of Sanitation offices in advance of putting out bulky objects and are told at what day and time a special truck will be dispatched to clear away the junk. In some areas the service is on a daily basis, some three times weekly and some less congested areas weekly.

The Junk Collection Week severely taxed the Department's facilities as householders responded with an outpouring of 5,396 tons of material. This discard was removed by the 160 trucks manned by 400 men. In addition to this tonnage, a considerable quantity of small sized junk material was removed by refuse collection crews while making their regular collection rounds. In addition to preventing a litter problem, the removal of these objects from attics and cellars did away with potential fire hazards for in many cases single residential buildings yielded a truckload of junk.

### *Cooperative Work*

In the spring, Mayor Wagner appointed Keith S. McHugh, President of the New York Telephone Company, as Chairman, and John A. Coleman, former President of the New York Stock Exchange, as Co-Chairman, to head a group of dedicated citizens to assist the Department in creating an enthusiasm for a clean city by mobilizing the citizens of the city for an all-out clean-up effort. The Committee was organized with chairmen in each borough, each Sanitation district, each Sanitation section. The board outlines of the Committee are:

1—To stir the pride of New Yorkers in the appearance of the City's streets, its homes, its vacant lots, its buildings and public places; to build through this pride a day-by-day effort to keep the city cleaner and more attractive;

2—To use all channels of education and communication to invite each and every citizen on a house-to-house, block-to-block basis to do his or her part;

3—To work with all City departments in their efforts to take up this voluntary campaign; and

4—To keep everlastingly at the task until New York becomes famous everywhere as the world's cleanest big city.

The Committee has secured a corporate charter setting it up as a permanent non-profit charitable and educational organization. It has organized the press, radio, television and other groups into active units and has secured services for its campaign, gratuitously from these organizations, which has an estimated monetary value of $2,000,000. Special announcements have been made over television and radio; posters have been set up in buses, cars, subways and other transportation media; groups of citizens have been organized throughout the entire city; and an active continuing effort is being made to clean up New York. It represents community endeavor at its best. Sparkplugging the drive for the committee is a fine, public spirited citizen, Sigurd S. Larman, President of Young and Rubicam, Inc., one of the largest advertising agencies in the country, who has contributed not only his time but that of his agency in organizing and developing the committee's public relations campaign.

All through 1955 the clean up drive continued with the latest enforcement program launched on October 24th. This began with a far reaching educational effort aimed directly at the residents of 3,057 heavily littered square blocks throughout the city. In ten days, the Department of Sanitation passed out more than one million circulars containing explicit instructions for the correct disposal of refuse and litter. On October 24th a special 250-man force from the Fire Department, Police Department and Sanitation Department embarked on an enforcement program to help clean up those heavily littered blocks.

The task of securing public cooperation normally rests in the Department's Office of Public Relations, headed by the Director of Public Relations, Frank D. Doyle. This Office plans and conducts the Department's public relations programs; ascertains and analyzes public opinion on the Department and its services; prepares and distributes articles, speeches and other materials to the press, radio and television and all other media of communication; promotes the public knowledge of the Department, its activities and services; and plans, conducts and administers a program of Sanitary Education. The Sanitary

(*Continued on page* 161)

● **INITIATING the litter basket program. Commissioner Mulrain and Borough Sup't. O'Connell are shown here.**

# THE DESIGN OF ····OFF-STREET PARKING LOTS

THE LAYOUT and arrangement of off-street parking lots will greatly influence their use. Well planned, attractive lots will not only be a pleasure to use, but can improve the appearance of otherwise drab areas. This will inspire other improvements in the surrounding business district.

A desirable parking lot location will nearly always involve use of high-priced ground. It is therefore important to secure the maximum quantity of car spaces. Each space may be worth several thousands of dollars over the life of the facility.

The shape and dimensions of the lot area will generally be fixed. Working within a fixed area, there may be several possible layout arrangements. By proceeding in an orderly fashion, and exercising good judgment, the best layout arrangement can be determined without too much difficulty.

The rectangular dimensions of the individual car parking space can vary within limits. Vehicles are growing longer and wider, and it will be best to be on the generous side in selecting the car space measurements. In choosing between the maximum and minimum aisle widths, consider the type of usage of the lot: Short limit, fast turnover lots should have generous width aisles to facilitate vehicle movement. Long limit, all-day lots may hold the aisle widths to a minimum.

There are three common arrangements for parking spaces: Parallel, which is used mostly for street parking, but may be used on a parking lot infrequently to fill up a narrow strip. Perpendicular, or 90 degree angle is most common. It has the advantage of permitting traffic both ways, and will generally work out with more spaces. Angle parking at 45 degrees is the next most common. Other angles may be used, but they will generally be of no advantage on a parking lot.

A suggested procedure is as follows: Accurately draw a map of the parking area to a suitable scale. Common scales are 1 inch equals 20 feet, or 1 inch equals 40 feet. Place a sheet of tracing paper over the map, for experimental marking. Several tracing sheets may be used, in experimenting with different arrangements. For safety and convenience, try to keep entrances away from street intersections. Roughly indicate entrances on the map. Finally adjust according to requirements of parking space aisles. Using the same scale, lay out and cut out paper strips representing rows of perpendicular parking spaces. See illustration for arrangement and dimensions. Arrange these strips on the parking area by trial and error, until the most logical solution is obtained.

If the perpendicular space arrangement does not use the area efficiently, then repeat the procedure using the 45 degree angle arrangement. Sometimes, some of both will need to be used. Left over areas may be filled in at any suitable angle. In using the angle space arrangement, check aisles for continuous traffic flow since one way movement will be necessary.

### *Parking Regulation*

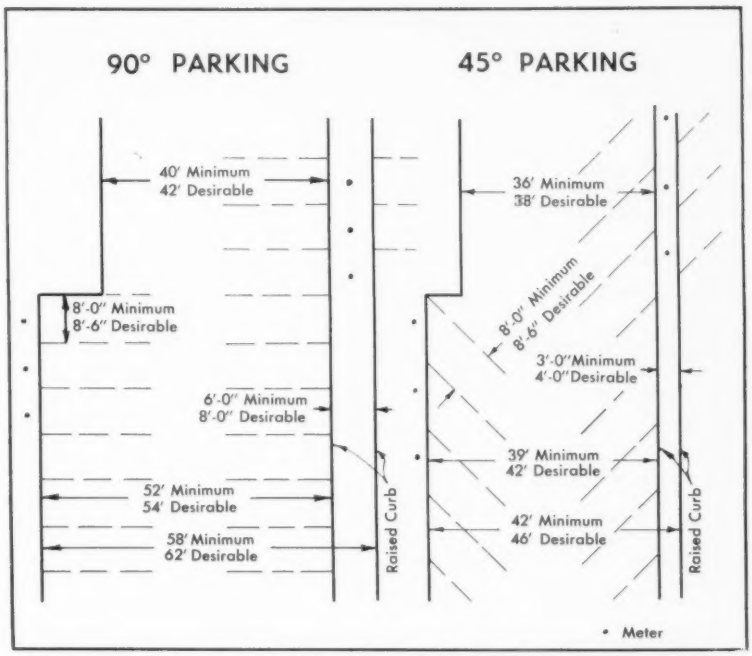
As with street parking, the efficient regulation of off-street lots will call for the installation of parking meters. On the layout, consideration will need to be given to the location and protection of the parking meter equipment. The most common, and perhaps the most satisfactory protection, will be with curbs which are contacted by the wheels of the vehicle. On permanent installations, curbs will generally be of concrete. The area be-

● **WELL-PLANNED municipal parking lot provides off-street parking in Decatur, Illinois. Flow-through pattern separates entrances and exits; meters handle tolls.**

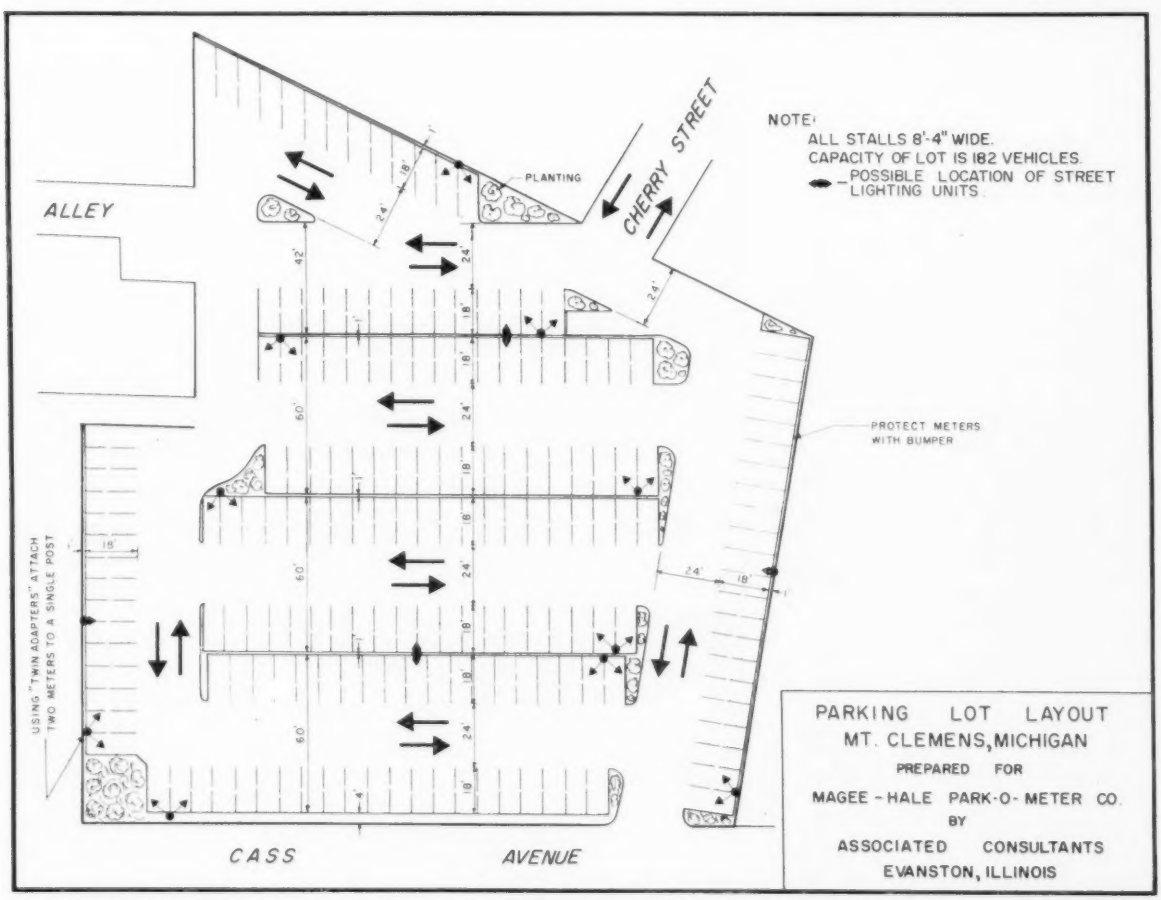
tween adjacent curbs may, or may not, be filled flush with suitable paving material. Required width of the curb enclosed area is determined by the parking angle. (See diagram). Another method of protection is by a suitable "stop" which is contacted by the vehicle bumper. These "stops" may be in the form of raised concrete footing around the meter pipe standard; or posts, or rails suitably mounted.

The possibility of landscaping the parking lot should not be overlooked. Any unused areas could be planted with low shrubs or grass. If sufficient space is available, larger shrubs or trees could be used. The beautifying of the lot is valuable in adding to the attractiveness of the surrounding area, and will help to avoid objections to lots in locations adjacent to residences.

The illustrative examples show typical lots which have been expertly laid out. The only satisfactory solution for adequate business parking must come from increased off-street facilities. Careful planning in the designing of these facilities will be rewarding.




● **BASIC dimensions for 90° and 45° parking lot arrangements. Note that nearly as much aisle width is required for one-side parking as for parking on both sides.**




● **ATTRACTIVE layout for the municipal parking lot in Mt. Clemens, Mich., includes provisions for lighting and landscaping.**

● **THE TWO DIGESTERS used at the New Milford plant are unheated and have a capacity of only 11,200 cu. ft. to serve a 1955 population of about 16,000 persons.**

# *FIELD TEST INDICATES VALUE OF DIGESTER ADDITIVE*

A FIELD test carried out during 1954 and 1955 involved the addition of FX-21, a sludge digestion aid, to the overloaded sludge digesters at the New Milford, N. J. sewage treatment plant. This plant, built in 1937, was designed to service 4,000 people and to handle a flow of 0.65 mgd. The solids disposal system consists of two unheated digesters, each with a capacity of 5,600 cu. ft.; and drying beds and a lagoon for final disposal.

The 1955 population of New Milford is about 16,000 and the flow of sewage about 1.25 mgd., far beyond the design capacity of the plant. This overload was felt especially in solids disposal. The average daily sludge removal to the digesters amounted to 560 cu. ft., providing a 20-day detention period in the unheated tanks.

The test was made in co-operation with James Entwistle, Superintendent of Public Works. The two digesters were drawn down to half capacity, so each contained 2,800 cu. ft. To Tank #1, 25 gallons of FX-21 was added; Tank #2 was used as a control, with no additive. Thereafter equal daily raw sludge feedings of 280 cu. ft. per day were made to each tank. As the tanks filled supernatant was withdrawn from any level—10, 13 or 16 ft.

The test started June 9, 1954, and continued as a controlled test through October. No sludge withdrawals were necessary from the treated tank during June, July, August or September; and 7,760 cu. ft. in October. Withdrawals from the control or untreated tank were 5,000 cu. ft. during June; 4,000 cu. ft. in each July and August; 3,000 cu. ft. in September; and 3,640 cu. ft. in October, a total of 19,640 cu. ft. during the period.

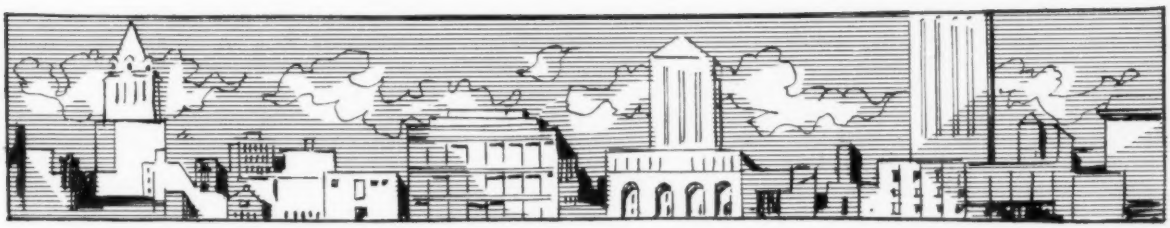
Beginning in November, 1954, FX-21 was added to both digestion tanks and operating results were compared with those for the same months the preceding year. No more compound was added to Tank #1 after the initial dosage in June until November. This portion of the test ran until April, 1955. During this period the pH never was above 5.4; no lime was used; and the temperature of the tank contents did not rise above 60°F. Daily sludge loadings were kept as equal as possible throughout.

With both digesters treated, sludge withdrawals from the tanks during the period November, 1954, to April, 1955, amounted to 10,000 cu. ft. During the corresponding period a year earlier, sludge withdrawals totalled 65,000 cu. ft., averaging nearly 12,000 cu. ft. per month.

From these results it appears that the additive, under conditions at New Milford, was exceedingly effective in improving sludge digestion under the heavily overloaded conditions that existed.

● **BEFORE digestion was improved, sludge withdrawals were made every ten days.**

● **THE UBIQUITOUS tomato plant grows on unused beds after digester treatment.**



# MUNICIPAL REFUSE

## ECONOMIES IN ITS COLLECTION AND DISPOSAL

**FRANK J. McDEVITT,** President, Board of Public Service, St. Louis, Mo.

IN THE COLLECTION and disposal of refuse there are many opportunities for economies. Collection costs can be reduced through shorter hauls. This means more and smaller incinerator plants. It is true that following this procedure will increase operating costs but, if a substantial revenue can be obtained through the utilization of waste heat, there will be an attractive net saving.

An ideal solution is to convert the waste heat into electric power, operating at unity power factor and 100 percent load factor. The power output can be disposed of to the local utility at ¾ cents per KWH, and thereby bring in a substantial revenue. Generally speaking, utilities should not be averse to such a deal because they are all short on power production and are anxious to maintain friendly relations with the taxpayers.

Refuse collections are usually conducted on a five-day, eight-hour basis with shut-down periods over the week ends. By having the plants strategically located, industries can deliver commercial refuse, so that the incinerators can operate continuously. The city should receive a fee of $5.00 to $7.50 per ton for burning this refuse. All of this adds to the annual revenue.

Either a steam or an air cycle turbo-generator can be used to develop electric power from waste heat. It is essential, however, particularly with an air cycle turbine, to use chain grate stokers with continuous burning instead of batch operation. If batch incinerators are used, cold air is admitted to the furnace when a batch of refuse is dumped, and this causes a drop in furnace temperature unless extraneous fuel under controls is used. The utilities will object to this procedure as they generally will not purchase power unless it is made entirely from waste heat.

### *Steam Cycle Plants*

In the steam cycle, attached to each 100-ton per day incinerator there is a 50,000-lb. per hour boiler with water cooled furnace and forced draft chain grate stoker. Attached is an economizer and air heater. Steam is furnished at 450 lbs. absolute and 200° superheat at turbine throttle and expanding to 2-in. absolute. The generator will develop 3000 KW at 0.8 power factor. A surface condenser requiring 6000 gpm of circulating water is required. Also there are the customary auxiliaries—boiler feed pumps, feed water heater, condensate pumps, circulating pumps, forced and induced draft fans, and 100-foot steel stacks. The total cost of such a job is about $4,500,000. This represents all standard equipment with no added tooling costs.

Fly ash fuses at about 2000°F and with a chain grate stoker using preheated air for combustion it is difficult to control furnace temperatures. Molten fly ash will stick to the tubes, and is difficult to remove with soot blowers. Overfire air under thermostatic control can be used in the furnace to keep a reduced temperature, but there will be an adverse effect on efficiency. Some fly ash will be trapped in hoppers underneath the economizer and air heater where it can be removed mechanically, but some form of fly ash arrester will be needed between the air heater and induced draft fan.

Refuse has a high and varying moisture content, particularly if garbage is included, and it is difficult to stabilize combustion without the aid of preheated air to flash off the moisture into water vapor. For many years horizontal forced draft chain grate stokers have been used to burn bagasse which is a waste product from refining sugar cane. About 15 percent of preheated combustion air is used under the grate and more is introduced into the furnace over the grate through each side wall. Having a properly designed furnace and special feeder the inclined chain grate can be dispensed with.

It is common practice in incinerator plants to use charging cranes for elevating refuse from the storage bin to the feed hoppers on the charging floor. By using a specially designed continuous bucket elevator with overhead automatic tipper and a magnetic separator for removal of tramp iron, it is possible to simplify operations and reduce labor costs.

### *Air Cycle Plants*

Gas turbines were developed some 50 years ago by foreign manufacturers who have since made numerous installations. In this country the gas turbine is a comparatively recent development and while only a few sizes have been built and installed in stationary plants, the progress on gas turbines for jet planes is amazing.

For incinerator plants the gas turbine could operate on low pressure filtered air. This air would be circulated through a specially designed tubular heat exchanger, and heated from 250°F to 1200° or 1300°F by using waste gases from the incinerator which are reduced in temperature from 1700°F to 450°F. Air is compressed from atmospheric pressure by an axial flow compressor, which is an integral

part of the gas turbine, to 66 psia and cooled to 250°F by an interor after-cooler, depending on whether the compressor is of single or two-stage type. There is a two-pound drop through the heat exchanger tubes, giving a pressure of 64 psia at the turbine throttle with an exhaust pressure of 15 psia. About 20 percent of the air needed for combustion is cooled to 400°F and used under the chain grate. Additional air, for combustion and for maintaining a temperature of 1900°F in the furnace to prevent fusion of fly ash, is admitted through the side walls. Some of the water vapor in the products of combustion is dissociated; to prevent secondary combustion in the heat exchanger, a small intermediary chamber is provided where additional preheated air from the turbine exhaust creates turbulence, completing any secondary combustion; and, under automatic controls, this provides a constant temperature of 1700°F at the entrance to the heat exchanger. Lastly, any surplus air over the uses mentioned above is admitted to the heat exchanger at a point where there is a corresponding temperature and it passes on to the induced draft fan at a temperature of 450°F. The success of these air admissions, as described, depends on the proper functioning of thermostatic controls.

A water cooled ash pit is not advisable as the water vapor arising therefrom increases the hazard of secondary combustion in the heat exchanger. A hinged ash pit door can be installed as a substitute at the tail end of the stoker and can be operated manually from outside. When ashes are dumped into a truck this door can be kept closed momentarily, and the hot ashes cooled by passing through an external spray ring.

The heat exchanger consists of a number of sinuous tube banks. The tubes are two inches in diameter, staggered, and about five rows thick. Spaces between banks are about thirty inches. This arrangement facilitates cutting out defective and welding in new tube sections. It also permits the products of combustion to speed up and check alternately, thereby dropping out fly ash into hoppers located below, from whence it can be removed mechanically. Undoubtedly this arrangement will obviate the need for fly ash arresters. In a gas-to-gas transfer the tubes at any particular location have a temperature of 150°F in excess of the gas inside the tubes. Since there is air both inside and outside the heat exchanger tubes it will be necessary to use chrome nickel alloy tubes in at least 60 percent of the inlet area in order to resist oxidation.

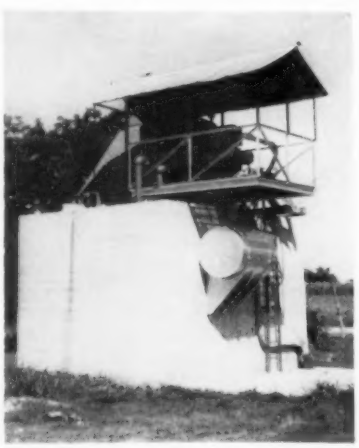
### *Efficiency and Costs*

The steam and air cycle turbines have about the same thermal efficiency. The basic condensing loss in the former is equivalent to the power loss in compressing a large quantity of air. The steam cycle requires a boiler, superheater, forced draft fan, boiler feed and condensate pumps, a condenser and circulating pumps, plus other minor accessories. These are not required on the air cycle turbine. Furthermore because of the need of a large volume of condenser circulating water, a steam plant should be adjacent to a body of water. The air cycle unit, not requiring water except for minor cooling which can be handled by a tower, can often be located more advantageously from the viewpoint of collections and of power delivery into existing utility lines at a minimum expense.

It is true that an air cycle plant is more costly, namely $6,000,000 as compared with $4,500,000. This difference is largely due to the cost of development and tooling for the air cycle plant. If a package unit can be decided on, as for consuming 100 tons of refuse per day, and operated continuously at unity power factor, then it would be possible to install four such units, carry the load of 3750 KW per unit on three units with one available for a spare at all times. Operating on this basis, 24 hours per day and 350 days per year, the revenue from sales of power at ¾ cent per KWH would be 3750 x 3 x 24 x 350 x 0.0075= $708,000 per year. Since collections of municipal refuse are conducted on a five-day per week basis, it would be necessary to secure 800 tons of commercial refuse in order to operate continuously. Bearing this in mind, incinerator plants should be located adjacent to areas where plenty of commercial refuse is available. If $5 per ton can be secured for burning this refuse, there would be 800 x 5 x 52=$208,000 additional revenue per year. It is plain to be seen the plant can easily be amortized in ten years after deducting $100,000 per year for operating labor, maintenance and supplies.

The proper way to handle this project is to select a qualified firm with a national reputation which can quote the municipality on a turnkey job. By this, I mean such a firm will examine local conditions and determine the location, number of plants and number of units per plant. They will then submit a proposal on the engineering design, construction, and operation for a period of time until the municipality is willing to take over. There should be a clause in such contract that when the municipality takes over they will retain the employees at the rates then being paid, with Civil Service recognition and approval.

## Sewage Pumping System Will Continue Come Flood or High Water



This Onan 50,000-watt Emergency Electric Generating Plant is installed on the top of a 15-foot high structure near the town of San Marcos, Texas. Providing emergency power for the operation of the San Marcos sewage pump, the installation was built in this manner because of the frequency of flash floods in that area.

The town's sewage pumping system is located completely underground, beneath the concrete structure. Should commercial power be interrupted due to storms or accidents, the Onan Model 50KA emergency plant will operate all vital equipment during the period of the power outage.

FENA RIVER WATER PLANT
SERVES NAVY ON GUAM . . .

# WATER TREATMENT

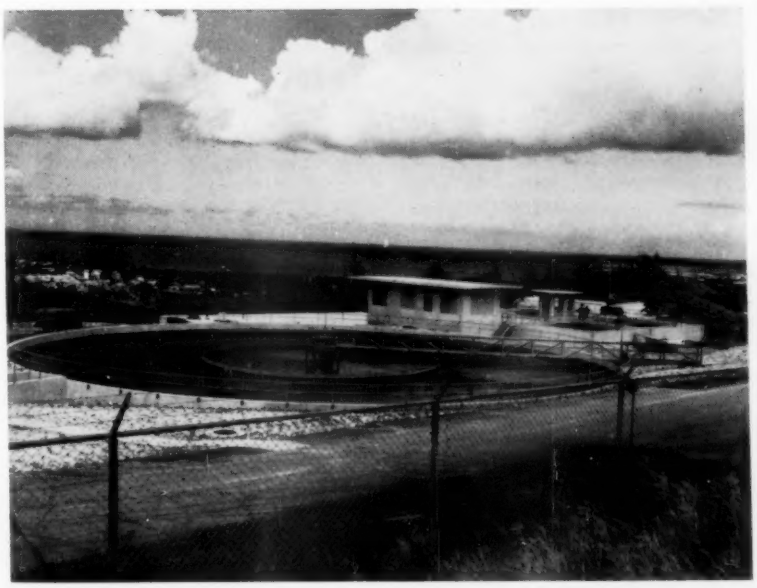
## MODERN STYLE, on a PACIFIC ISLAND

WATER FOR the Fena Treatment Plant comes from an artificial lake created by the construction of the Navy's Fena River Dam comprising 5800 acre feet of usable water storage. Water is stored during the rainy season and passes from the lake through a screen house where two sets of Link Belt traveling water screens are installed. The water then goes to the Pumping Plant where four DeLaval centrifugal pumps, rated at 2500 gpm and driven by four 300-hp Westinghouse motors, deliver the water through 15,500 feet of 24-in. cast iron pipe to the treatment plant.

Two Wallace and Tiernan chlorinators at the Fena Pumping Station are used to chlorinate the raw water being pumped to the plant. Another source of raw water is the Almagosa Springs from which the water flows through 16,375 feet of 10-in. cast iron pipe, by gravity to the water treatment plant at a rate of from 1 to 2 mgd depending on the season.

The Fena supply line and the Almagosa supply line are both brought into a single influent chamber. Just prior to the entry into this chamber there is installed on each line an air operated butterfly modulating valve actuated by a liquid level controller located in the pretreatment tank. With this arrangement the water supply is automatically throttled when there is a lack of demand on the down-stream side of the plant.

From the influent chamber the water flows through a venturi tube with a flow transmitter which indicates, records, and totalizes on the receiving meters located in the Filter Plant and in the Chemical Building. The water then goes through a second chamber where the chemicals are added and thence on to the center of the pre-treatment tank. Here the chemicals are gently but thoroughly mixed in the reactor chamber by a recirculation pump for approximately 30 minutes before the water flows into the sedimentation compartment where it is retained for approximately three hours for removal of precipitated solids. From here the water leaves over a double weir effluent launder and flows by gravity to the filters. The sludge settling to the floor in the sedimentation compartment is removed with rotary sludge rakes bringing the sludge to an outlet hopper near the center of the tank. From here it is moved by a sludge pump pumping it into a waste water drain system.



● MODERN water treatment plant on Guam produces a safe water. The supply is mostly from surface sources, brought to the plant through a 3-mile cast iron line.

The clarified water from the pretreatment tank flows by gravity through the effluent line to the filter gallery where it is distributed through four influent connections, one to each filter. Each filter contains two bays. Each bay is 14′ x 28′ making a total filter area of 784 square feet per filter unit. The filter has a conventional gravel layer and uses as the filter media graded anthracite coal. During the back wash cycle the two bays of the filter are washed simultaneously.

The water passes from the filters to a 1-million gallon clear-well for distribution to several storage and balancing reservoirs on the island. The plant is controlled with Foxboro equipment. The laboratory is located in the Chemical Building where the chemical feeding equipment is also housed. Chemicals are injected into the raw water by Oliver Slurry Pumps. There are two slurry tanks for limestone and two tanks for sulfate, one tank being in operation while the other is being prepared. Each slurry tank has an agitator in continuous operation to keep the slurry in suspension while being pumped. The capacity of the plant is 12 mgd. At present two more filters are under construction. When they are completed it will increase the capacity to approximately 16 mgd. The plant is in op-

Data and photographs are from
E. A. Daday, CDR, CEC, USN
Acting Commander
Public Works Center
Naval Station, Guam, M. I.

eration 24 hours a day, 7 days a week.

The design of the plant was based on the following considerations:

(a) Flash aeration for a partial removal of carbon dioxide gases and taste and odor constituents.

(b) Chemicals addition to include the use of locally available calcium carbonate, for stabilization and as a flocculation aid, and a suitable coagulant.

(c) Flocculation and sedimentation is a combined pre-treatment unit which includes mechanical flocculation and continuous sludge removal equipment.

(d) Rapid sand filtration, using filters of modern design with back wash provisions and necessary control equipment.

(e) Automatic post-chlorination, with facilities to permit manually controlled pre-chlorination.

(f) Addition of stabilizing compounds, such as small dosages of sodium metaphosphate, to the plant effluent when required.

(g) Adequate chemical storage and feeding equipment.

(h) Proper facilities for chemical and bacteriological control.

The site of the plant was selected specifically to allow gravity flow of the water through all stages of the treatment procedure.

Red water control has been tried and found successful on Guam. Control started out with 10 ppm phosphate which was cut down gradually to 2 ppm after nine months while maintaining a residual at the end of the line.

The entire plant indicating and totalizing system is pneumatically activated. There is one pneumatic system for pilot control and a second system for operational control. One system works the recorder and the other operates the valves and gates.

From an economic standpoint it was decided to use crushed Guam coral rather than calcium carbonate brought in from stateside. This eliminates 5625 lbs. estimated daily demand of calcium carbonate. The Guam coral is ground wet in a ball mill with classifier to 325 mesh.

Prior to treatment the following conditions existed: (a) From a mineral standpoint all waters were satisfactory for human consumption. (b) When measured by the calcium carbonate index, all waters were unstable. (c) Scale forming tendencies, resulting in serious maintenance problems, were noted. (d) The water supplies, as used prior to treatment, exhibited pronounced corrosion qualities. (e) The chlorine consumption, for domestic water treatment only, was estimated at 12 ppm. This dosage is abnormally high and contributes to the corrosion tendencies of the water.

As a result of treatment the scale forming tendencies of the water were greatly minimized, the corrosion tendencies reduced, the chlorination also reduced and red water tendency eliminated.

● **FENA RIVER filter plant has a capacity of 12 mgd, is being increased to 15 mgd.**

## RCA Installs Combined Microwave-Mobile System

A combined Microwave-mobile radio system which provides for police, maintenance and general administrative communications along the entire route of the new 241-mile Ohio turnpike, has been installed by the Radio Corporation of America. The comprehensive RCA system provides eight voice and teletype channels and will link all major turnpike installations and vehicles. The system represents a cost of more than $1,200,000, including a seven-year contract with the RCA Service Company for around-the-clock maintenance. The overall communications system is divided into two operating divisions, eastern and western, to provide maximum radio traffic with minimum signal interference. Separate voice and teletype channels are installed for each division. The microwave portions of the overall system will be utilized for point-to-point communication from the toll plazas to the maintenance centers.

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## Rainfall Records in New Orleans

Records of maximum storms in New Orleans, La., go back for at least 50 years. The heaviest single rainfall was in 1927, with 14.01 ins., of which 3.39 ins. fell in one hour and 7.88 ins. in five hours. This storm lasted 19 hours. However, the heaviest 5-hr. rainfall was 10.38 ins. in 1929. The heaviest 1-hr. rainfall, 4.71 ins., occurred in 1946; the heaviest 15-min. rainfall, 2.43 ins. in 1925; and the heaviest 5-min. storm, 1.28 ins., also in 1925. These two latter were the same storm, and it produced a 30-min. total of 2.61 ins. Annual rainfall over the 50 years has averaged 57.05 ins., with a minimum of 33.51 and a maximum of 79.21 ins. There were 14 storms in 1954 with a precipitation of one inch or more.

• • •

## A Rat Control Program For Toledo

The city council of Toledo, O., has approved the operation of a rat control program within the City's health department. Four inspectors are to be added to the health department sanitation division. The planned program includes an educational campaign coupled with the baiting of rat infested areas and work at the City dumps aimed at eliminating rat harborages.

# "FABRIC-IN-ASPHALT" for AIRPORT RESURFACING

ONE of the nation's busiest airports, Detroit's Willow Run, this past summer became the first airport anywhere to use the "fabric-in-asphalt" process for major resurfacing of some of its vast pavement areas. Reason for the resurfacing, involving the half-mile long center taxiway and the 3500-foot west ramp, was to improve and extend the life of the original pavement in some areas and increased its ability to carry the loads of today's planes, up to 75,000 pounds on a single wheel. Welded wire fabric reinforcement of the 3-in. thick bituminous concrete was specified to reduce the amount of "reflective" cracking of the new surface over the somewhat badly cracked unreinforced concrete slabs.

The original airport pavement, built in early World War II years, is 6 to 8 inches thick, and was unreinforced, due to steel shortages. In certain areas, the 10 by 20-foot slabs, broken into smaller sections, with a good many corner cracks formed, especially at points of heavy traffic, were requiring extensive maintenance of the joints and cracks. The new resurfacing, fabric-reinforced is expected to reduce this maintenance cost as much as 70 percent. Approximate cost of the improvement project was $160,000, with Civil Aeronautics Administration putting up $80,000 to match the total of $40,000 each put up by Michigan State Department of Aeronautics and the University of Michigan. The University is owner of the sprawling facility and, in turn, leases the commercial airport portion to Airlines National Terminal Service Company. Low bidder for the work was Howell Construction Company of Howell, Michigan. E. S. Brewer, Sons, Owosso, Mich., were the consultants.

Outstanding contribution of the contractor to speedy production was the "hold-down" device he designed. (Purpose of a "hold-down" is to prevent the steel fabric from entangling in the paving machine.) It consisted of a five-inch heavy duty steel channel outside each cat track of the Barber-Greene finisher and three 3-inch heavy duty I-beams, suspended but spaced rigidly between the tracks. These channels and I-beams extended from the front of the paver's hopper to just short of the hot mix conveyor screw. The entire length of the device "rides" along the steel fabric, keeping it flattened out ahead of the hot mix.

● **PAVER lays 2-inch base course of bituminous concrete over wire fabric reinforcement. Channel iron, suspended by chains, holds the fabric flat and out of way.**

Principal point of difference between the foregoing and "hold-down" devices used on previous jobs elsewhere in the country was that the Howell device was double-ended, slightly turned up like a sled at each end, and was fastened to the paver with chains at both ends. This enabled the paver to be completely mobile; it could be backed up, turned, and jockeyed into position, without any loss of time. The double-ended sled offered nothing for the fabric to catch on, and required no special attention. On the north end of the west ramp, where six side-by-side 10-foot wide passes were made, by turning the machine at the end of each lane and paving in the opposite direction, 1330 tons of binder were placed in a 12-hour day. On the second best day, 1285 tons were placed. Only production delay on the job occurred when the trailing end of one of the outside channels became bent up too much and allowed the fabric to catch in the feeder screw. Flattening the bend of this sled corrected the trouble and the job proceeded smoothly.

Another innovation involved the placing of the 3 x 6—10/10 welded

wire fabric reinforcement. Previously, it had always been deemed advisable to place and fasten before the paver only enough sheets of fabric to keep the job going. On this job, however, fabric for an entire lane 1810 feet long was placed, then "shot" with a quick-setting emulsion tack coat.

The mix truck drivers being well instructed, no twisting or bending of the fabric sheets was encountered, and, not being tied to the slow moving paver, the steel crew was able to work ahead speedily and more efficiently. Placing the tack coat over the steel, instead of vice versa as on many previous jobs, was also an innovation which worked well and spared the steel workers walking in the sticky emulsion.

In placing the sheets of steel fabric, workers lapped the first width 3½ feet across the first longitudinal joint of the area being resurfaced. The 9½-foot wide sheets for successive lanes then were placed, allowing 6 inches clearance between sheets, and thus all the 10-foot spaced longitudinal joints in the old portland cement pavement were covered by fabric.

The fabric sheets, 8 feet long and 9½ feet wide, were placed so that the three-inch spaced transverse wires were down, and at right angles to the direction of paving. This placement eased the passage of the paver, allowing it to "ride" along the longitudinal wires, in effect. As an additional precaution, sheets were lapped away from the paver, although with the Howell hold-down device, it was possible to pave against the laps. The sheets were fastened on the four center longitudinal wires with quickly placed hog rings.

Rolling on the job was done with a 12-ton waterfilled Galion roller. Before starting resurfacing, approximately 45 of the most severely cracked slabs in the center taxiway were removed and replaced with air entrained, steel fabric reinforced portland cement concrete. The center taxiway, used as access between the terminal and runways by all aircraft, showed the greatest signs of use. Because of this, it was selected as a control section to show the effectiveness of welded wire fabric in reducing reflective cracking.

Starting at the intersection of the taxiway and the NW-SE runway and the NE-SW runway, and extending west for 575 feet, four inches of resurfacing has no reinforcement. Then follow three 400-ft. long sections alternating without and with fabric. Prior charting of the cracks in these sections will furnish data on the effectiveness of the fabric's "crack control." (The rest of the taxiway was reinforced).

Specifications for the asphaltic concrete called for a 2-inch binder course weighing 224 pounds a square yard and a 1-inch surface course at 112 pounds a square yard. The binder mix consisted of 69.1% 9A stone with a maximum aggregate of 1¼ inches; 26% 3BC sand; and 4.9% 120-150 Pen. A.C.

The entire project, covering approximately 70,000 square yards, required nearly 90 tons of welded wire fabric, and about 14,000 tons of bituminous concrete. It was completed in 21 working days. Due to the nature of an airport's operations, weather, and other conditions closed down work several days, in the interest of safety, both of the planes and the workers.

Numerous inspections during the course of the job showed that the welded wire fabric had risen an average of ½-inch up into the binder course, a point at which previous experience indicates it will be most effective in controlling and minimizing reflective cracking.

Morley Durston was job superintendent for Howell Construction Company. In on the planning of the project, in addition to the contractor and L. C. Beckert of the Brewer consulting organization, were J. P. Weidenbach, airport manager for ANTSCO; Floyd Wakefield, airport manager for the University of Michigan; and Prof. William Housel of the University's Civil Engineering Department.

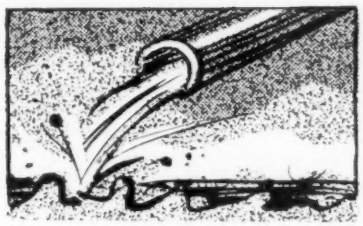
## 54 House Footings Dug in One Day

A Cleveland Trencher under the expert direction of a thoroughly skilled operator has dug footing trenches for 54 houses in one day near Los Angeles. The excavating job for each house includes trenches for interior and exterior walls and for house-service water lines as well, a total of over 300 lineal feet of trench per house, 13 inches wide by 12 inches deep.

Using Cleveland Trenchers exclusively, the firm of J. C. Bowles & Son of Whittier, California has dug nearly 60,000 such house footings since 1950. Bowles employs four men in each housefooting crew, a layout man, an operator of the Cleveland Trencher, an oiler or stake man and an operator for a small scraper which spreads and levels the earth excavated by the Cleveland. Key to the high rate of production is the extreme maneuverability and quick responsiveness of the Cleveland, enabling it to cut short runs of trench at high speed, then turn out quickly without loss of speed to resume digging again in a different direction until all trenches for a single house have been dug, then move quickly to the next house site to start again.

The speed with which the skilled operator puts his Cleveland through these "gymnastics" keeps his stake man on the jump, placing and pulling line markers as the work progresses. Equally adept in the handling of his machine is the operator of the scraper which follows the Cleveland closely, spreading the soil from the trenches within seconds of its excavation. The entire operation by men and machines is so highly synchronized and coordinated hardly a word needs to be spoken at any time on the job.

● **INTRICATE pattern of footing trenches shows need for high maneuverability.**



# Study in Waste Water RECLAMATION

AN EVER INCREASING demand for water, an intensive use of surface supplies and over-pumpage of ground waters, mostly since 1940, have led to declining water tables and, in many coastal areas, to a loss of producing aquifers to intruding sea water. The search for more water must include a study of the reclamation of waters generally considered as municipal and industrial wastes. Various public agencies, including the University of California have sponsored research on various aspects of the problem. A report recently issued by the Sanitary Engineering Research Laboratory of the University of California brings together and evaluates the pertinent results of these studies, principally those in which the Laboratory had a part. This article is based on the summary of that report.

Domestic sewage represents one of the most important sources of reclaimable wastes, amounting in California to some one million acre feet annually, or about one-half of the present overdraft on ground water basins. Industrial waste waters, especially those from food processing and such others as can be kept separate from economically unreclaimable liquid wastes, are of increasing importance. Flood waters and surface drainage constitute another major source of reclaimable water, subject to their own peculiar problems and to seasonal occurrence.

Largely through a change in concept of water use, sewage treatment with discharge to a watercourse is becoming recognized as a reclamation procedure. Other methods include ground water recharge through surface spreading, over-irrigation, or direct injection of waste or excess water into underground water-bearing formations. The advantages and shortcomings of these proposals determined as a result of experimental studies are outlined in the report.

The fact that ground waters exist and are replenished by rainfall demonstrates that ground water recharge is possible. Engineered recharge, however, requires vastly increased recharge rates over relatively small areas, plus the introduction of waters of a quality less suited to entering the ground. Thus technical problems are involved. Accompanying such problems are complicated legal questions, but for the purpose of the report, it is assumed that legal questions are not insurmountable if water reclamation is technically feasible.

### *Recharge By Spreading*

In 1953 some 219 recharge undertakings were reported to be in operation in 32 states, about one half of these being in California. Among the best known are the fresh water spreading operations of Los Angeles County Flood Control District, and the direct recharge of well waters on Long Island. Many of the others are empirical attempts to dispose of waste waters by surface ponding. In 1930 it was shown in Los Angeles that a highly treated sewage plant effluent could be safely returned to the ground water. Further tests at Whittier and Azusa in 1949 showed that much rougher sewage plant effluents could be recharged into the ground water. Spreading studies with surface waters were begun at Bakersfield in 1936, and for the past ten years have been continued by the Soil Conservation Service. From these studies have come some of the most significant contributions to our knowledge of the phenomena of infiltration and percolation.

Studies with sewage plant effluents have been conducted at Lodi, and at Richmond, Calif., by the University of California, under its own and other public sponsorship. In all of these studies various operational procedures and soil treatments have been investigated with the general conclusion that water or sewage plant effluent can be returned to the ground water without danger to the public health through pollution travel, and at rates of from 0.5 to 1.0 acre foot per day per acre of surface spread. The known principles of infiltration and percolation are discussed in the report, and data are presented to show the limited nature of bacterial movement in soils. Experiments are also reported which show the feasibility of predicting the field performance of soils on the basis of relatively simple lysimeter studies.

### *Recharge By Injection*

For more than 25 years the direct recharge underground water-bearing formations has been seriously considered. For a number of reasons the method might be preferable to surface spreading. The possibility of creating a hazard to the public health as a result of bacterial or chemical pollutants moving with the ground water has, however, been a deterring factor. Another drawback has been the ability of suspended solids in a water to clog the pores of an aquifer, thus making continuous recharge impossible. In combination, these two factors have made the direct recharge of sewage plant effluent seem both hazardous and difficult in the extreme unless expensive

works were constructed to upgrade the quality of the waste water, in which case it might better be utilized directly. Nevertheless, treated sewage continues to represent such an impressive volume of water that its reclamation by ground water recharge continues to hold economic possibilities in water-short areas, provided public health considerations and technical problems are not insurmountable.

Reported experience in ground water recharge is quite limited, the most extensive being in oil fields where injection of brines into deep strata of low permeability has been accomplished at rates of from 0.15 to 1.0 gal. per minute per foot of aquifer. Successful ground water recharge with fresh water at Long Island has been accomplished at rates up to some 8.5 gal/min/ft of aquifer thickness. These experiences, contributed little, if anything, to a knowledge of operational and pollution travel problems associated with the injection of waste waters, such as sewage, containing suspended and dissolved organic matter. Accordingly, the California State Water Pollution Control Board sponsored a field study of direct recharge into underground formations. The work was carried out by the University of California at its Engineering Field Station in Richmond. A summary of this investigation is presented in this report along with data on some other pertinent studies.

In the Richmond studies fresh water was recharged into a pressure aquifer having a permeability of about 1900 gal/sq ft/day at a rate of 8.4 gal/min/foot of aquifer (about one-half the safe yield of the well under pumping) for long periods without difficulty. The addition of sewage plant effluents at the same rate, however, caused clogging of the well at a rate proportional to the amount of solids injected. Under permissible well head pressure buildup, a sewage equivalent to the final effluent from secondary sewage treatment could be injected for about 8 or 9 days. At that time redevelopment was necessary. Chlorine injection followed by a half day of contact and three or four hours pumping at a rate equal to twice the injection rate completely re-established the ability of the aquifer to receive injected water. The discharged water amounted to some four percent of that recharged and was easily separated from its suspended solids for reinjection underground if desired. Experience with recharge well operation demonstrated the necessity for gravel packing of the recharge well.

### *Public Health Aspects*

The downward movement of bacteria with percolating water is shown to be of little concern, both by previously reported experience and by experiments under field and pilot plant conditions. In fine soil at Lodi, Calif., a bacterially acceptable water by USPHS Standards was obtained by percolation through four feet of soil. Observations with coarser soils showed a greater depth of penetration but no situation developed which would be of serious public health significance in a practical spreading operation, although it must be presumed that some organisms will reach the ground water under certain conditions.

The travel of bacteria with moving ground water was observed in the Richmond experiments. Sewage effluents containing coilform concentrations as great as $4.7 \times 10^6$ organisms per 100 ml were injected at various rates. In no case did observed travel exceed 100 feet in the direction of ground water flow, or 63 feet in other directions. Concentrations of organisms at these distances were 23 or less per 100 ml. The removal of bacteria by an aquifer is shown to be a function of distance and aquifer filterability rather than of rate of recharge. The conclusion is reached that the reclamation of waste water by direct recharge into sand aquifers is not limited by public health considerations. It is recommended, however, that provision for monitoring the ground water bacterially and chemically be a part of any practical recharge project.

Travel of chemical pollutants with ground water is not limited in the manner observed for bacteria except in the case of biochemically unstable dissolved matter. Consequently it may be presumed that industrial wastes carrying toxic or noxious chemicals must generally be excluded from waste waters to be injected underground.

### *Engineering and Economic Aspects*

Results of studies discussed in the report show that no special treatment is necessary to prepare a final sewage plant effluent for ground water recharge by spreading or injection. No unresolved engineering problems occur with either waste or flood waters. Over-irrigation, however, is shown to be a generally impractical method of ground water recharge because of geological limitations on its applicability and difficult legal considerations. Normal irrigation, however, may be an economical method of utilizing certain waste waters directly.

From an economic standpoint the cost of installing and operating recharge wells is governed by the cost of making usual geological investigations, constructing wells of a normal type, and installing and operating ordinary water handling equipment. Therefore, water reclamation by ground water recharge is subject to a straight forward engineering analysis.

• • •

## Chicago's New Radio-Controlled Intersection Units

TRAFFIC LIGHTS at twelve busy Chicago intersections will be co-ordinated soon by radio intersection units now being field-tested by General Electric design engineers at Electronics Park. At rush hours each day, radio signals will be transmitted from atop Chicago's highest building to the intersection units. The radio signals will cause the time cycles of all traffic at the twelve intersections to be changed and synchronized so that traffic will be speeded up in the direction of the greatest flow. When the equipment is placed in operation it will be the world's first radio co-ordinated traffic light control system. These units have been designed by General Electric electronics engineers.

● TRAFFIC engineers examine radio receiver which will control signals.

# APWA News

**AMERICAN PUBLIC WORKS ASSOCIATION**
**1313 EAST 60th STREET, CHICAGO 37, ILLINOIS**

## MEMBERS RECEIVE NEW YEARBOOK

Copies of the 1955 edition of the Public Works Engineers' Yearbook were mailed to all members of the Association last month. This new publication contains the names and addresses of all members plus the proceedings of the Milwaukee Public Works Congress. A Case Study on *Developing A Refuse Collection Program*, with comments by the nation's foremost authorities on the subject, is one of the features of the new yearbook. Also included are twenty formal papers covering a wide variety of topics of vital interest to public works officials. Members receive this publication as part of their regular membership service. Non-members may obtain copies from the headquarters office (1313 East 60th Street, Chicago 37, Illinois) for the price of $5.00 per copy.

## CHAPTER ACTIVITIES

### Arizona Chapter Elects New Officers

The Fall meeting of the Arizona Chapter of the American Public Works Association was held in Globe, Arizona, November 13, 1955. Phil J. Martin, Manager of the Tucson Water System heads the new slate of officers which were elected for the coming year. Other officers included Dario Trevaini, Supt. of Water and Sewers of Phoenix, Vice-President; Robert G. Williams, City Engineer of Winslow, Secretary-Treasurer; and George W. Marx, Director and Chief Engineer of the Arizona State Health Departments Bureau of Sanitation, and Guy R. Rhoads, Manager of Municipal Utilities of Safford were named Directors-at-Large.

The program featured an informative talk on Civil Defense by K. W. Hammes, City Engineer of Globe who also serves as Civil Defense Director of that City. After discussing the responsibilities of utilities in disaster situations, two films of atomic explosions at the Nevada Atomic Test Site were presented and narrated by the speaker. Murray D. Snyder, Supt. of Sanitation of Tucson, who participated in the atomic tests conducted in the Pacific Ocean several years ago, also took part in the discussion.

### Huss Speaks At Michigan Meeting

The November Meeting of the Michigan Chapter, held at Hucks Redford Inn in Detroit, featured a talk on "Current Legislation" by John H. Huss, Director of the Michigan Municipal League. Results of the election of officers for 1956 were also announced which places Jan Schmedding, Supt. of Street Construction and Maintenance of Detroit at the helm. Harold M. Hulquist, Managing Director of the Concrete Pipe Association of Michigan, J. P. Jewell, Supt. of Public Works of Pontiac and Fred R. Cheek of Trenton were elected First, Second and Third Vice-Presidents respectively, and Charles A. Johnson, City Engineer of Midland was named Secretary-Treasurer.

**President**
Edward P. Decher

**Vice-Presidents**
Frederick W. Crane — W. M. Swietlik
Kenneth K. King — Albert G. Wyler

**Past President**
Warren A. Coolidge

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**Treasurer**
Robert L. Anderson

**Executive Director**
Donald F. Herrick

# WHY PAVING COSTS VARY

**JAN SCHMEDDING**
**Supt. of Street Construction & Maintenance**
**Detroit, Michigan**

*EDITORS NOTE: This article is based on a talk given at a session of the 1955 Public Works Congress and Equipment Show.*

THE STREET DIVISION of a municipality is charged with the responsibility not only of constructing new pavements, alleys and public places but also maintaining present pavements along with considerable related work, as sidewalks, rail crossings and a host of other things. This could be a complete operation by the municipality or on a contractual supplemented basis. In either case, the one could gain at the expense of the other, depending on the allocation of the different types of work. The area to be covered could be a highly concentrated one or might include a system of widely scattered projects. It is important in discussing the costs of paving to find common ground from which to start. In any survey made to arrive at certain findings, comparison must be made between areas of like characteristics. We must first of all find a common approach.

The physical set-up required could call for any of several types of installations. A maintenance plant is one thing, a production plant another and a combination of the two is still another thing. It makes considerable difference cost-wise as to how one is required to operate. Production could well be on a seasonal basis. Maintenance might well be a year around affair with the vagaries of the weather and other conditions to contend with. One could have ways and means of obtaining the

ultimate in plant equipment. The other could be hamstrung by related departments in acquiring proper machinery. One might provide the very minimum set-up for a certain type of work for a limited time while the other keeps well within specifications and is flexible and readily available for many different jobs on a moment's call. Within certain areas, extra equipment is required in controlling obnoxious conditions caused by plant operation.

The various types of construction and the balance required with one in regard to the other is a prime factor. The new pavement has to do with grade preparation, utility openings, curbs, thickness of slab and possibly a bituminous surface. Recapping of the old surface is a variable factor. The number and thickness of each separate course, the comparative size of the average job, all have a bearing on costs by yard. A minimum amount of preparation would no doubt entail mostly hand work, where larger areas would be cleared by mechanical means. Naturally, the thicker the course, the more tonnage can be laid in a given time but also less area will be covered. Surface treatments differ widely as to types and ingredients used which make it difficult to catalog comparable jobs.

In the case of municipal paving operations, especially in the larger cities, supply of personnel generally is accomplished through Civil Service and a personnel division. While their rules and regulations were designed in the interests of the city as well as the employee, at the same time they place restrictions on free operation. Changes in personnel are often delayed through involved procedures. Benefits accruing to employees, along with the delays, force the employment of excess help. In a smaller operation or on a contractual basis, it might be possible to acquire just enough help to accomplish the work for a season or a certain project and retain no encumbrance once it is finished. Again, the quality of the work would in many cases suffer because competent help was not available on this basis. Skilled help during the season is generally at a premium and the increasing use of power is reducing the use of common labor.

Specifications start at the national level and follow down through the various governmental agencies as far as engineering service is available. Some are very rigid in character and others are rather loosely prepared. Some are designed to furnish the very ultimate in paving perfection while others are strictly planned to make use of local materials which can be readily obtained on a dollar and cents basis. Nomenclature in the field of aggregates and bitumens lack absolute uniformity in designation and from area to area present a problem in placing them in a proper related category. Trade names and combinations of numerals and letters relating to materials are generally uniform only when confined to a certain area. Keeping within specifications, which are usually set up on a variable basis, is one thing. Blending mixtures with the materials, received to produce a well-balanced, quality product is quite another.

Natural resources in some cases provide an abundance of desirable materials, and the by-products of industry sometimes furnish a satisfactory supply of synthetic materials. In other instances, it becomes necessary to transport the necessary ingredients a considerable distance. Being so favored, certainly places one area in an advantageous position over another. At the same time, the handicapped area might resort to the use of less desirable materials with the presumption that the lower quality might be offset by the differential in price. In view of this, the first cost must be balanced against the life expectancy, taking into consideration the ease and amount of maintenance.

Worthwhile leads to significant savings can frequently be discovered by analyzing comparable cost data in different localities. Any evaluation of paving costs however, must take into account the variable factors just discussed, if it is to be of any value in revealing where possible economies can be made.

# 20 Precautions for Lubricant Handling

1. Where large volumes of lubricants are used a central oil storage house, set apart from other facilities, is always best.

2. Avoid storage on wood floors for woodwork soaks up oil and grease from handling and becomes a fire hazard.

3. If possible have doors and windows of steel frame or roller type and fitted with wire glass and automatic closing devices.

4. Have lubricant storage facilities close at hand in order to reduce transportation time involved.

5. Where lubricants are stored in barrels or drums it is always best to have hoisting equipment handy.

6. Good temperature control in storage enables all types of lubricants to be handled much more efficiently. Wide temperature fluctuations mean sweating and condensation of moisture in containers.

7. Pumps, meters and other measuring devices will quickly save their cost over hand operations where even moderate quantities are involved.

8. Keep oil drums on end and always check storage conditions to see that no water can get into opened drums.

9. Make certain bungs and seals on drums are always kept tight to avoid moisture and other contamination as well as to prevent dripping.

10. Have drum seal and bung wrenches at hand in the storage house.

11. Store only a slight excess of the amount needed. Lubricants are always better when fresh. Large stocks invite contamination and waste.

12. Keep monthly lubrication records for better and more accurate control of both stores and maintenance records.

13. Always have suitable containers at hand to catch all oil drips.

14. Have reliable fire protection equipment close at hand near oil storage and make sure this equipment is tested regularly and often.

15. Have a regular clean-up routine of all storage facilities as well as on machinery and equipment, particularly following a regular lubrication job.

16. Collect and keep all oil-soaked cloths in covered metal containers and have them washed before they are reused.

17. Have sand on hand in sand boxes for fire protection but keep these away from oil containers. Sand is a damaging abrasive when suspended in lubricants of any kind.

18. Get tough when someone permits spilled or dripped oils to accumulate anywhere . . . that generally means trouble of one kind or another.

19. Have it a hard and fast rule that all spilled oils or other lubricants are wiped up immediately. They are not only a fire hazard but are easy for someone to slip upon with resultant personal injury.

20. Avoid the use of lint-shedding rags for wiper cloths. Lint, when lodged in bearings or oil circulation mediums, will clog and cause damage.

THE BUFFALO-SPRINGFIELD K-45 KOMPACTOR

# How to select compaction equipment

The logical question to ask yourself when you are ready to buy new compaction equipment is: "Exactly what do I need the equipment for and how will I use it?"

**BASE FILL COMPACTION**—This type of compaction demands equipment that will handle a wide variety of materials, give you the highest degree of compaction with the fewest passes. Buffalo-Springfield's revolutionary K-45 Kompactor is proving a real money-making answer for this type of work. It is self-propelled, relies on the "Interrupted Pressure Principle." All compaction effort is directed downward. Contractors testify they are meeting density requirements in one-fourth the time normally required with other compaction equipment.

**FINE GRADE FINISHING** — Buffalo-Springfield offers six 3-wheel rollers, ranging in capacity from 5 to 15 tons, to handle the large variety of materials found in fills, subgrades and unfinished bituminous pavements. The variable-weight 3-wheel roller is ruggedly built for years and years of hard, maintenance-free work.

Buffalo-Springfield's thoroughly-proved 3-axle tandem "walking beam" roller provides up to 60% greater tonnage compacted per day in superhighway construction, airport and military establishment jobs where specifications are extra strict.

**ASPHALT FINISHING** — Two-axle Tandem Rollers are designed especially for all surface finishing jobs. Ranging from 5 to 16 tons, Buffalo-Springfield Tandems are used for

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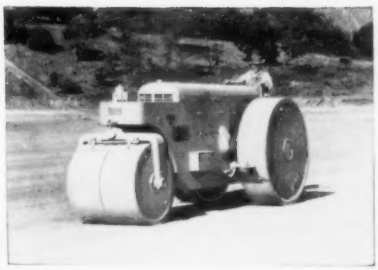
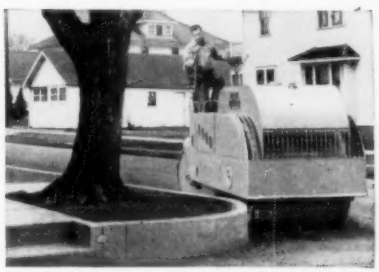


3-WHEEL ROLLERS

heavy-duty highway and public works projects, and all types of finishing, maintenance and repair work. A wide selection of models for the biggest to the smallest jobs are designed for long-life and profitable operation.



TWO AXLE TANDEMS

**SHORT ROLLING JOBS**—Buffalo-Springfield's 3-5 ton portable roller is widely used for rolling driveways, sidewalks, parking and playground areas, and for patching and light fin-

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ishing jobs. It is highly maneuverable and portable from job-to-job. Write today for full information on the type of equipment you need—or see your nearest distributor for an on-the-job demonstration.

*The Standard of Comparison*

**BUFFALO SPRINGFIELD**

**SPRINGFIELD, OHIO**

Now's the time to mail this month's Readers' Service Card.

# Increasing Engineering Productivity

*This is a portion of a paper by A. C. Clark, Deputy Commissioner, Engineering Division, U. S. Bureau of Public Roads. It was presented at the meeting of the Construction Committee, AASHO at New Orleans, Louisiana.*

THE NATION'S BILL for engineering services for the combined Federal-aid, State, county, urban highway and toll road programs has risen from about $40 million in 1945 to approximately a half billion dollars in 1955. It will continue upward with expanding road programs in the years ahead. Engineering services relating to the total Federal-aid work in the program and plans-approved stages and under construction as of September 30, 1955, will cost approximately $280 million, of which about half will involve Federal funds. The Bureau of Public Roads thus has an interest in cooperating with the State highway departments in developing means of improving productivity in highway engineering operations.

This interest goes further. It is necessary to get the job done. Current practices often require up to 21 months elapsed time, and in some instances even more, from the date legislative authorized funds are apportioned to the actual commencement of construction. This delay is due in part to financing and right-of-way acquisition problems and in part to administrative determinations as to policies and priority of projects for programing. A substantial portion of the elapsed time, however, is consumed in performing the actual preliminary engineering operations. It is not easy to recruit more engineers and engineering aids to speed up these operations. The call for such personnel in other construction fields is growing for work both here and abroad.

An August, 1955, article "A Familiar Frustration" reflects the trend. It reported that one Department of Highways after interviewing 180 engineering graduates at 20 southern colleges secured 15 of the 75 young engineers it was seeking. It was also noted that this year's civil engineering graduates from all colleges in that State were only a part of the number required by the Department of Highways.

A brief discussion of other construction requirements is desirable as an indication of the environment within which the growing highway program must operate. It will develop a better understanding of the need for streamlining engineering practices and for the adoption of new technological methods consistent with sound project control principles to make possible more effective utilization of manpower, not only of engineers but also of engineering aids and other personnel involved in supporting activities.

Our population is skyrocketing at the rate of a new birth every eight seconds and a net gain of one person every twelve seconds. To the construction industry that means a new city of 200,000 people each month. Each such new city must be supplied with new homes; commercial buildings; public utilities including water, sewer and electrical power installations; hospitals; churches; schools; highways and other facilities necessary to support and service our modern way of living.

The high rate of production of automobiles and trucks has also encouraged mobility with shifts in population from region to region, from farm to urban area, and from city to suburb, creating pressing demands for suburban construction.

Construction is also necessary to fill the backlogs still existing because of inadequate past levels of construction due to depression and war. These construction requirements are over and above normal needs to offset depreciation and especially obsolescence in the maintenance of our high level of economy.

These facts relating to the construction requirements of this dynamic Nation are reflected statistically. The level of all forms of construction both public and private in 1949 was $22.2 billion. In 1954 it was $37.6 billion. Current estimates show an 11 percent increase in the rate to $41.8 billion for 1955. The Departments of Commerce and Labor jointly estimate that the construction level will further reach a $44 billion level in 1956.

Within the current rate of construction, the volume of State and local public works exclusive of Federal facilities is far below estimated requirements for the coming 10 years. Surveys disclose that over $200 billion worth of public works are needed by 1965 including $41 billion for schools, $13 billion for hospitals, $25 billion for water and sewer facilities, $101 billion for highways and over $20 billion for other State and local public works. This amounts to an expenditure of $20 billion for each of the next 10 years compared with the $8½ billion of construction work put in place on these types of non-Federal public works facilities during the record-breaking year of 1954.

### Electronic and other Devices

A highway plan for years to come is already in the making. We are not, however, overlooking the fact that as highway programs increase so do engineering requirements. It is obvious that not all of the increase in engineering requirements is likely to be met merely by hiring more engineers, engineering aids and other supporting personnel, so we have been evaluating new processes and technological advances that may be helpful in increasing productivity in engineering operations to meet construction schedules. The streamlining of existing procedures, extension of the use of photogrammetry and more intensive application of electronics in the planning, design, construction and operation of highways are most promising means of increasing productivity.

As an example, extensive progress has already been made in the adaptation of electronics to highway maintenance and operating functions. The use of two-way radio in the management of mechanized maintenance by over 200 highway departments has emancipated engineers from desk routine and decreased the number of central office engineers needed for field liaison work. The engineer at all times has complete control of activities under his jurisdiction and the whole organization has become a coordinated flexible team rather than relatively independent groups of men and equipment. Productive time is increased for each crew or individual proceeds to the next assignment without the nonproductive time required for someone to drive to a telephone or the office for instructions as to the next job. Mechanics can reach equipment that breaks down in the field and get it back in service much more quickly than formerly possible. Public relations are improved because complaints can be handled more satisfactorily.

Big machine performance at low original cost! That's the all-new, *double-line* M-B LineMaster — the most advanced line marker available, having the extra features, rugged construction and line laying capacity of units carrying a much higher price tag. With the new LineMaster you have a marker engineered to do a better job than any other unit in its price class. Together with all the exclusive features shown below, you get additional advantages like ample power and air reserve for continuous double line work; 3″ to 6″ wide lines, regular or reflective, solid or intermittent (with optional timer); big, heavy duty jet spray cups; a self-propelled marker, one-man operated with speeds of 3 to 5 miles per hour.

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— Paint flow, pressure controls — air pressure, tank capacity gauges — right before operator at all times. Simple, interlocking bar controls single or double line marking.

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Electronics has moved in on highway construction. It is being used to increase the productivity of the resident construction engineer. His presence on the job is insurance that when unexpected situations arise, decisions will be made on sound engineering bases and construction can be continued without delay. But such situations arise only occasionally on most projects so that with the installation of two-way radio on the site and in the resident engineer's car, he can assume responsibility for two, three or even more projects in an area. His engineering potential is thus more fully utilized.

Radio is also used to control the flow of materials between the central mixing plant and the pavement construction site. In another operation, electronic controls are used to set the mix of concrete to specific proportions and to discharge it into waiting trucks for delivery. Punch cards, one for every mix the plant produces, are dropped into a mechanism and automatically activate the electronic controls so that in proper order and in proper amounts, cement, aggregates in whatever of six different sizes are required, and water are weighed into the mixer. Mixing time is also governed by the controls as is the tilting of the mixer and its discharge.

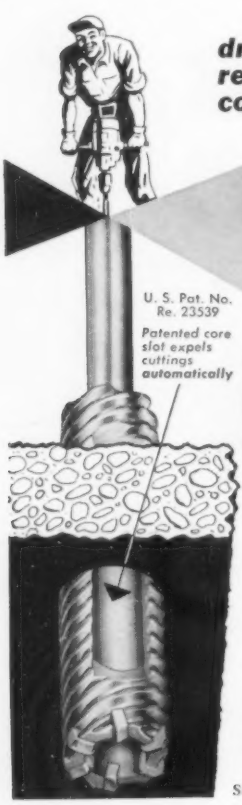
Electronics are also used in truck weighing. The equipment consists of floating surface slabs whose movement is recorded on an oscilloscope and revolving drum. Not only is the weight of trucks obtained without the necessity of diverting them to a conventional scale but also the weight and speed of traffic can be obtained for use by traffic and design engineers.

Industrial television is being used to an increasing extent to maintain continuous vigil at critical or hazardous points on our highways. It is installed in the tunnels of the West Virginia Turnpike, on the John Lodge and Edsel Ford Expressways in Detroit, and on the San Francisco Bay Bridge, and it is contemplated for the Massachusetts Turnpike. When an accident or hazardous condition occurs, police and maintenance forces can be sent to the spot quickly. Inductance radio is also being used along highways at critical spots and motorists through their car radios are advised of hazardous conditions, traffic, jams, accidents or other emergencies while they are driving along.

Signs which can be remotely controlled by radio are now being tested. They are constructed with multiple messages, any one of which can be selected to suit the particular need. For example, motorists can be warned of snow, ice, fog, accident, construction operations or a variety of hazards that might lie ahead simply by pressing a few buttons on the control panel at headquarters which light up or expose the desired message on the signs along the highway.

Electro-mechanical axle counters and tabulating equipment are used to keep accurate records of the number of vehicles using toll roads daily as well as recording the proper revenue associated with this traffic. At the conclusion of each day's operation, these data are taken from recorders at each interchange together with toll tickets and revenue, and at a central auditing point fed to automatic machines which compute the total vehicle count and revenue.

The city of Chicago is working on an electronic device which through a central dispatcher will remotely change the traffic light program at specific intersections as traffic loads change. Near the village of Philadelphia in New York, experiments

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are being carried on with warning signals on curves and other dangerous highway sections. The warning signs are actuated to flash a warning signal by traffic moving at excessive speeds.

The recently completed Highway Research Board survey of time-saving methods in highway engineering relating to location and road and bridge design discloses increments of progress toward modernizing highway engineering practices, but there is no concerted effort on a broad enough scale for a full modernization of highway engineering practices.

### Aerial Surveys

Aerial photography is securing the greatest recognition from the States. Forty-six States have indicated that they are using aerial photography in varying degrees. The principal use has been in highway location for which it is reported that the wider coverage and more complete detail provided by aerial photography makes possible better engineering analysis. Other time-saving uses of aerial photography reported included the determination of access data for limited access facilities, retracing section and property lines, locating possible deposits of aggregates, procuring bridge site data and developing display data for use at public hearings.

In plan preparation, savings have been realized in some States by the modification of the content and format of construction plans to eliminate repetition and unnecessary data, by the increased use of standard sheets for drainage structures, by the substitution of typing for lettering and by the use of photographic processes to make cloth reproductions. Of outstanding interest in the field of earthwork computations is the "Contour Grading Plan" under development in California and the mechanized procedure developed in Oregon.

In bridge design the adoption of standard plans and the development of tabular data and charts to replace or reduce computations have been the principal time-saving methods. Design data for which such methods have been developed and applied include influence lines for continuous spans, tabular data for deck slabs, arch and rigid frame analysis, pile footings, and diaphragms, shear connectors, circular columns, rivet groups, and curves for wind force components.

As extensive as this improvement may be, it appears to be only a fraction of what it can be with the adoption of new electronic devices including high-speed digital computers. Many hours of engineers' and supporting personnel's time are now used in manual processes in engineering operations. The use of electronic computers offers the possibility not only of decreasing the time and cost of computation but also of effecting substantial reductions in the cost of capital improvements. Time saved by these modern devices together with the advantages inherent in them will permit broader and more complete investigation leading to more economical location and design and more rapid advancement to the construction stage.

The Bureau of Public Roads has assigned engineers to study the application of high-speed electronic computers to highway engineering operations and to consult with industries as to the use that has been and can be made of these machines. Extensive conferences have been held with manufacturers of electronic computers. Some of the more important problems in which the use of high-speed electronic computers can increase appreciably the productivity of engineers and supporting personnel are: Traffic and planning; sufficiency ratings; signs and signals; drainage; bridge design; highway location; final estimates; and surveys.

### $30 Billion for Earthmoving

Highway needs studies show that $30 billion of the $101 billion highway needs found to exist over a 10-year period will be for the purpose of earthmoving. The initial effort of the Bureau of Public Roads' engineers, therefore, relates to the combined use of photogrammetry and high-speed electronic digital computers in location, design and construction work involving the economies of earth movement.

It is estimated that where the conventional method of plotting field notes, checking, inking, templating, planimetering and computing volumes requires from 90 to 100 man-hours per mile at a cost of about $200 for personal services, the electronic computer method would require only about 3 man-hours per mile at a cost of about $20 for personal services plus rental of equipment.

Another method of earthwork computation is being studied which would eliminate field cross sectioning entirely. It is the "horizontal slice" or "contour grading" method in which the closed figures formed by the original and final contours at each contour elevation are planimetered and the volume computed by summing the products of the average areas and the contour interval. The possibility of mechanizing this computation by using an "electric eye" or an electronic curve-following device connected with a digital computer to integrate the areas is being explored with the Bureau of Standards Computation Laboratory. The computer would also average areas and compute volumes all in a continuous operation. Under this method the preparation of cross-section sheets as well as the field cross sectioning can be eliminated. Slope stakes would be set from offsets scaled from the topographic map.

There have been numerous suggestions for the development of time-saving methods through the further application of photogrammetry, the use of electronic computers, or a combination of both which will require field testing and evaluation. These suggestions are now being considered.

1. The establishment of alignment and grade from data developed by photogrammetric methods and the closing of traverses by electronic digital computers.

2. The expanded use of photogrammetry for evaluating alternate route locations and the computation of earthwork quantities for each line by electronic digital computers.

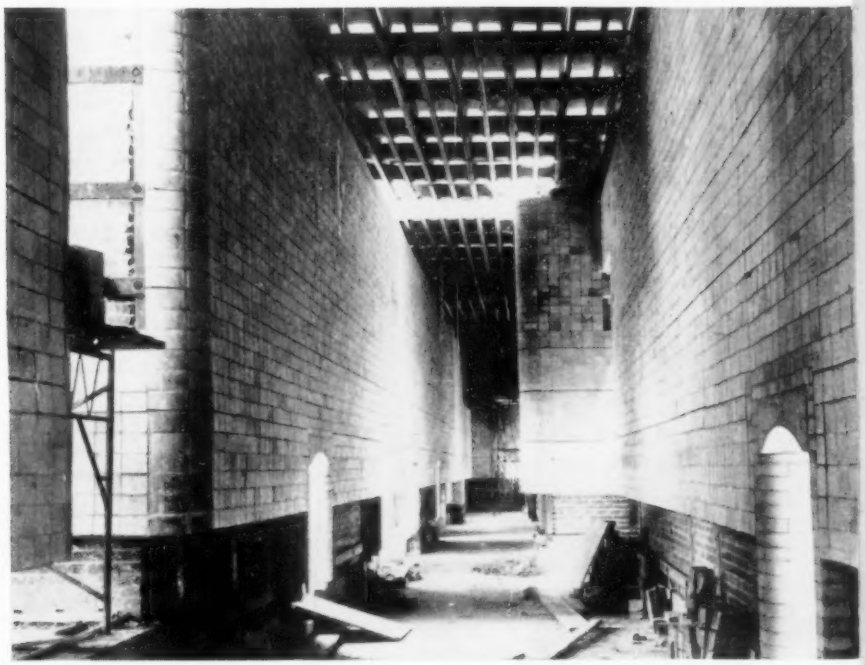
3. The expanded use of photogrammetry for evaluating alternate route locations and the computation of earthwork quantities by the horizontal slice method from contour maps developed by photogrammetric methods instead of the electronic computer method or the slower conventional manual method. In this method field cross sectioning, as well as cross-section sheets, are eliminated.

4. The extension of 2 or 3 above to final line location and the calculation of the engineer's estimate.

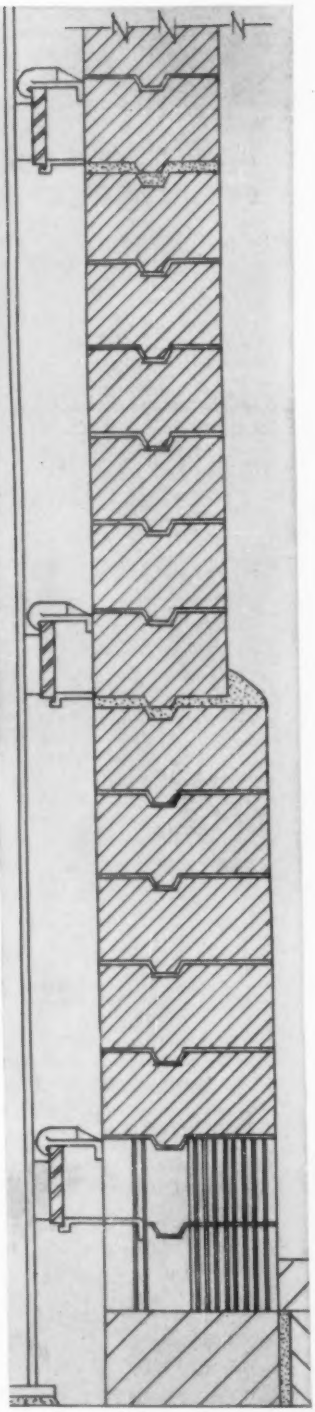
5. The extension of 4 above to final pay quantity determinations.

6. The use of photogrammetry and high-speed electronic computers for selection of the final line and computation of engineers' estimate quantities. This would be followed by advance clearing and grubbing contracts after which the center line would be staked and cross sections taken to compare earthwork quantities obtained from them with those obtained earlier by photogrammetry and electronic computers. The proving of close agreement would assist greatly in gaining contractors' acceptance of the use of quantities de-

# *New trends in the use of refractories*



Municipal incinerator H-type wall under construction



H-Type wall illustration shows tile spacing, support, and flexibility of wall thickness.

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1. **Flexibility of design**—refractories are free to move on suspensions, and castings free to move on the frame—with no sacrifice of proper calculated support.

2. **Lower costs through standardization**—minimum refractory sizes and shapes required, all standardized, low-cost tile.

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Be sure to check this new H-type construction for your incinerator. Talk to your Laclede-Christy representative. If you're not quite ready, save this message as a reminder.

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*Simplex Air Inlet Valves* quickly admit air, prevent a vacuum, protect lines from collapse. They also vent air when lines are being filled to stop binding, increase efficiency. Standard 4" to 10" sizes. BULLETIN 1202

Pipeline collapse due to vacuum

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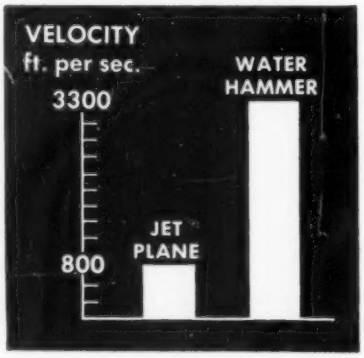
• Sudden closure of a valve can set up hammer that travels 4 times faster than the fastest jet . . . fractures valves, ruptures long lines.

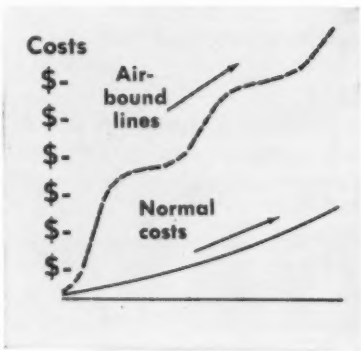
*Simplex Type CCAV Valve* ends these dangers. It controls transfer time, and releases both air and water to prevent damage. And lets in air to prevent vacuum collapse if breaks occur or lines are drained. BROCHURE




## HOW TO CUT PUMPING COSTS

• When air lodges in high spots, it cuts the effective area of pipe, creates a friction head, lowers pumping capacity . . . and may cause water-hammer.

*Simplex Air Release Valves* end these troubles. They vent air automatically to eliminate binding, increase efficiency, cut pumping costs. Simple, rugged 2" size, for up to 250 psi., costs you little, quickly pays for itself! BULLETIN 1200

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veloped by electronic computers from photogrammetric data for pay purposes thus eliminating the taking of cross sections specifically for pay purposes and the computation of quantities from them.

Other variations of these methods have been proposed. There is now under observation in Pennsylvania a project in rugged terrain involving several million dollars in excavation in which engineers' estimates were based on aerial photography and the computation of quantities by conventional methods. The invitation for bids provided that final payment for earthwork would be based on quantities computed by the average end area method using cross sections developed from topographic maps made from aerial photographs. There was extensive competition in the contract letting and the successful low bidder was below the engineers' estimate.

Because of the many variations of possible time-saving methods that exist, the Bureau of Public Roads has prepared an outline including the various alternate methods for field testing purposes. It covers the following six operational stages:

I Reconnaissance of area
II Reconnaissance of alternate routes
III Preliminary survey
IV Determination of final line and computation of preliminary earthwork quantities
V Location survey (staking final line ready for construction)
VI Computation of "tentative pay earthwork quantities"

It is planned with this outline to establish test sections on forest roads in two of our western divisions and to make time, cost, manpower, and quality studies of both the conventional methods of performing the engineering functions and the new methods using photogrammetry and high-speed electronic digital computers, so that specific comparisons can be made.

The outline for the proposed test sections is appended for study by the various State highway departments and to serve as a comparative check list against the operations as now performed. Should any State desire to develop similar test sections on its own initiative, the Engineering Division of the Bureau would be glad to furnish whatever information we have assembled and developed on the subject. By pooling and exchanging experience obtained in such tests, the development of new time-saving engineering methods can be accelerated for the benefit of the entire profession.

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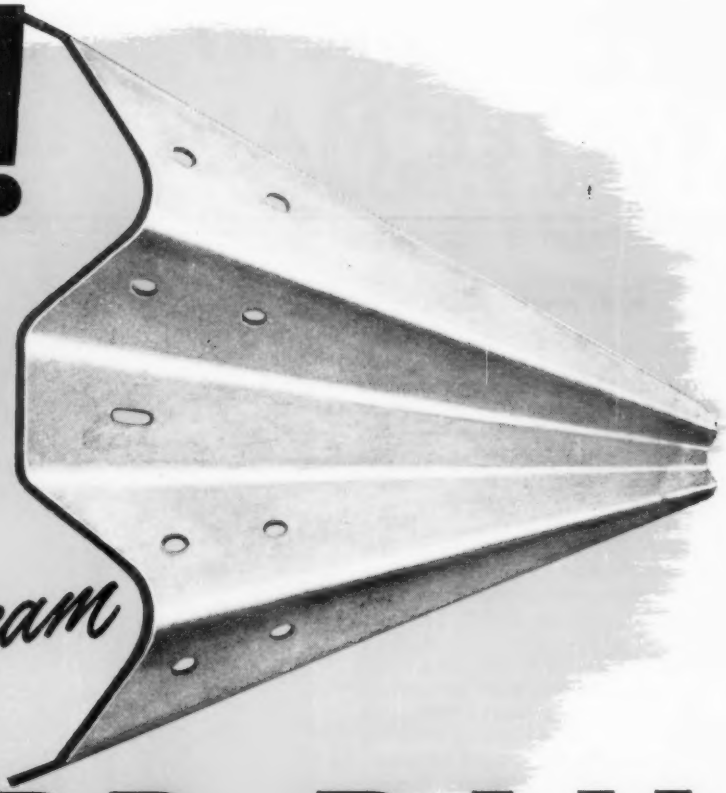

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USF Universal-Beam . . . a new companion to the nationally famous safety top USF Barrier-Beam Guard Rail . . . now provides another effective contribution to the cause of highway safety.

This new Universal-Beam Guard Rail in either 10 or 12 gauge is an interchangeable, rugged deep beam section offering maximum protection, excellent visibility, and high impact strength.

Universal-Beam's wide center corrugation serves as a bumper guide and the edges are turned back for safety. The wide lap joint assures high beam strength.

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# REINFORCING WATER MAINS IN TACOMA

A. R. MacPHERSON

SOME 50 or 60 years ago Tacoma, Wash., was achieving fame as the lumber capital of America. With some of the world's largest sawmills operating there the idea of using anything but wood water mains was naturally considered treasonable. As a result, Tacoma laid countless miles of wood water pipe. But, as the city mushroomed in population from 36,000 in 1895 to 150,000 by 1948, production of water jumped from 6 mgd to 100 mgd in 1948. Meantime, the wood mains gave increasing trouble, but replacement with iron pipe proceeded with costly slowness over the years. Even the first wood-stave pipeline, constructed in 1913 to bring the main water supply from the headwaters of the Green River, was not replaced with 58-inch steel and concrete pipe until 1948.

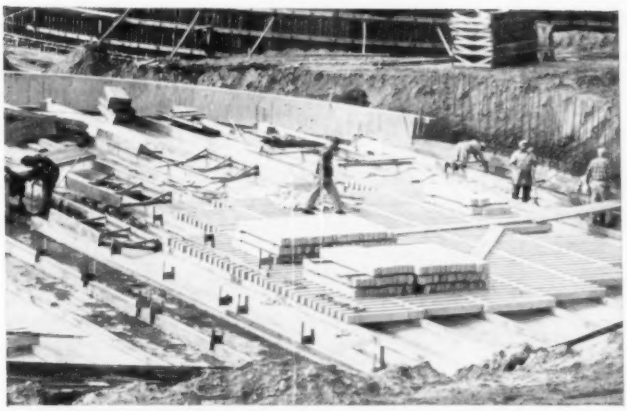
In recent years repair and maintenance of the wood mains had become a costly and a constant headache to the city water division, according to W. A. Kunigk, Superintendent of the water department. Large water losses have occurred through the wood pipes by leakage and breaks. He states that the old wood main lines frequently failed when fires required water to be pumped through them under increased pressure. Also, the county health department objected to the wood mains because of possible water contamination when negative pressures occurred.

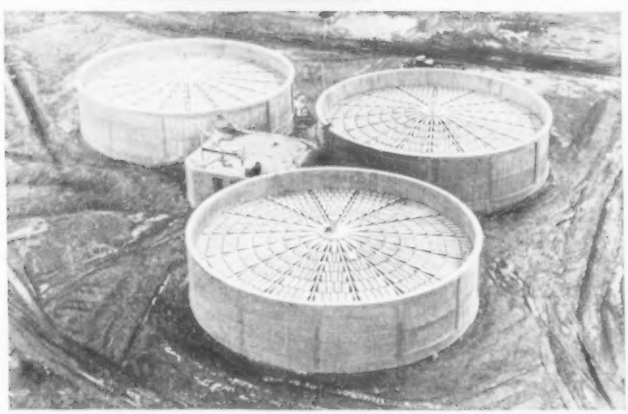
● **TRENCHING and laying of the new mains proceeded rapidly on the level prairie sections of Manitou. A 22-B backhoe opens the trench and lifts the pipe into place.**

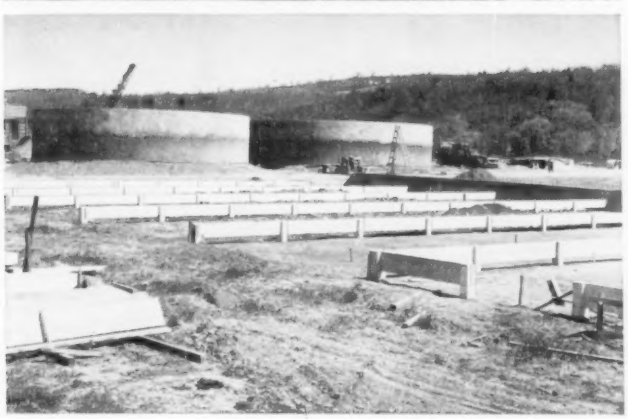
● **DEEPEST hill cut, shown in the background, is being completed by a 38-B backhoe. In some places, cut was 40 ft. and trench was 50 ft. wide at the top.**

Although the wood pipes were well tarred and closely wound outside with heavy wire, they outlived their usefulness many years ago. The prolonged delay in replacing them was due largely to financial reasons—the increasing costs of replacement projects and the necessity of waiting until property assessment valuations would permit construction. Also, department policy, unless emergency dictates otherwise, awaits the initiation of projects by the property owners.

This year the water division has carried out the largest improvement program in its history, with projects totaling $334,000 started and others waiting, in a concerted endeavor to eliminate most of the old wood distribution lines. The program involves 22 projects located in all parts of the city. Some projects were instituted by property owners, some by private contractors and others by the water division itself. At the end of 1954 the city still had 38 miles of wood mains. When the current projects are completed, only 15 miles will remain in use.







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# CONCRETE UNITS
## offer many advantages for Modern Sewage Treatment Works

Precast concrete units are being used more and more in sewage treatment plant facilities. There's a good reason. Precast concrete units offer all the advantages of conventional concrete construction—plus speed, economy and easy handling. Here are typical recent examples:

**FILTER UNDERDRAINS** of the six trickling filters in the East Providence, R. I. Sewage Treatment Plant are precast, reinforced concrete beams (top photo). Because of concrete's great strength they could be used as cribbing to support the weight of the crushed traprock filter medium.

**DIGESTER COVERS** in the East Providence plant (second photo) are 2-in.-thick, tongue-and-groove precast concrete planks. Since concrete resists rot in a damp atmosphere, it was chosen over less durable materials.

Covers for the digester tanks of the Benton Harbor-St. Joseph, Mich. Sewage Treatment Plant (third photo) are short slabs of precast concrete that rest on purlins connecting radial girders. Crevices between slabs are calked with mastic. Triangular spaces between slabs and girders are filled with grout. Covers are 80 ft. in dia., rise 3 ft. from the outer edge to the center.

**SLUDGE BED PLANKS AND POSTS** in Elmira, N. Y. Sewage Treatment Plant are precast concrete units (bottom photo), part of a million-dollar plant addition. Durable precast concrete units can withstand a lifetime of weathering and freeze-thaw cycles in such installations.

Precast concrete construction is moderate in first cost, requires little maintenance, serves for years. The result is ***low annual cost,*** the real measure of the economy of any construction.

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Among the major improvements now under way is a $144,000 project located in the Manitou Park district and calling for the replacement of old 6, 8 and 12-inch wood mains with 8-inch cast iron pipes supplied by the U.S. Pipe & Foundry Company. Milone & Tucci, Inc., Tacoma contractors, with A. G. Clark, Superintendent, handled the project, laying approximately 31,000 feet of new iron mains through the Manitou area. The old wood distribution line, which had become badly deteriorated, is left in place. The new mains are being placed deeper than the old lines and in between them and the ¾-inch service pipes to the homes.

This operation required considerable dexterity on the part of the trencher operator who had to know the exact location of each service pipe so he could manipulate the shovel as carefully as possible around and underneath the pipe without interrupting water service.

A 22-B Bucyrus-Erie crane, equipped with a ¾-yd. back-hoe bucket, was employed for part of the trench work. Trenching and laying of the new pipe along the earth borders of the black-topped streets proceeded simultaneously. After the crane excavated a short stretch of 7-ft. deep trench in the level, soft prairie soil, it hoisted an 18-ft. length of iron pipe and workmen positioned it carefully into the pipe line at the measured level. Pipe joints were immediately formed with lead. The crane then dumped two or three buckets of fill dirt over the pipe to hold it in place and proceeded to excavate another pipe-length stretch of trench. Each street line of new pipe was tested under water pressure for leaks. City workmen carried out the job of installing new tie-in pipes from the iron mains into the homes; a D-4 "Cat" loader then shoved fill dirt over the line.

Tougher and more vexing operations faced the engineers along the northern boundary of the Manitou area where all the streets ended up against a long, steep hill. The project called for running new mains through the hill on each of eight streets to service a new home area along a street paralleling the hill top. Since none of the streets ran through the hill, a great deal of difficult excavation was called for in order to place the new mains at a sufficient depth so that they would not have to be moved again when the streets, which will eventually be cut through, are brought to final grade.

On each of the eight street ends it was necessary to cut down the top of the hill by depths ranging from 5 feet at the west end to 40 feet at the east end. Top widths of the cuts ranged up to 50 feet to prevent cave-ins and dirt slides. After cutting down the highest part of the hill as much as 40 feet, a 10-ft. deep trench was dug at the bottom of the cut to get the new pipeline down to the required grade. Since the dump trucks were unable to operate on this steep hill, engineers employed a novel method for disposing of the dirt. A new 38-B Bucyrus-Erie crane equipped with a ¾-yd. back hoe-bucket excavated all the hill cuts. A D-6 "Cat" bulldozer operating alongside the crane shoved the excavated dirt to the brow of the hill where it cascaded down to the street below. The "Cat" loader then scooped up the dirt, filling GMC and International 5-yd. dump trucks which hauled it away.

With fast, efficient team work on the part of a good crew the eight hill cuts and trenches were completed in 3 to 6 days each. Trench-

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PROVIDES A TRULY
PERMANENT SEWER JOINT
Atlas JC-60 effectively STOPS ROOTS. This plastic base sewer jointing compound prevents root penetration by combining two important properties . . . hardness and adhesion.
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ing and laying of the new mains on the streets of Manitou took up most of the past summer, with installation of the numerous shut-off valves on each street, requiring considerable time and careful testing.

John N. Stenger, senior engineer in charge of the Manitou project for the city, reports that nine new petitions for water main improvements have been filed with the water division. Bids are being called for an $80,000 water main project in the Salishan area and for a $34,000 main replacement job in a west Tacoma district. In addition, numerous smaller replacement projects are scheduled.

• • •

### Civil Engineering Fellowships Available

The School of Civil Engineering and the Graduate School of Purdue University announce the availability of approximately twenty-two graduate fellowships for the summer session, June 11 to August 4, 1956. The fellowships will be made available to selected applicants who are teachers or research personnel in Schools or Departments of Civil Engineering and who are qualified and interested in asphalt and flexible pavement technology and construction. Requests for application forms and information should be addressed to Professor K. B. Woods, Head, School of Civil Engineering, Purdue University, Lafayette, Indiana.

• • •

### Public Health Engineering Positions Available

Public Health Engineer I salary $4500 to $5160 per annum. Minimum requirements, sanitary, civil, chemical or mechanical engineering degree. Public Health Engineer II (for air pollution control) salary $5160 to $6129 per annum. Minimum requirements same as Engineer I plus 2 years experience in public health engineering, industrial hygiene or air pollution control or combustion engineering. For full information write Personnel Dept., Room 127 City Hall, Philadelphia 7, Pa.

• • •

### Lagoon for Treating Sewage in Minnesota

A lagoon has been constructed to provide secondary treatment for the sewage of Warren, Minn. The lagoon has an area of 40 acres and an average depth of about 4 ft. The population of Warren is about 2,000.

• • •

### Paid For Water and Free Water in New Orleans

While 40,983 million gallons of water were treated and pumped by New Orleans, La., in 1954, only 54.2 percent of this was sold. Of the total treated and pumped, 4.8 percent was free water, delivered to city departments and charitable institutions entitled to this by law; free water for sewerage amounted to 4.0 percent; an allowance amounting to 0.2 percent was made for leaks in piping and fixtures, 36.8 percent of the total went to unmetered free users, as for extinguishing fires, cleaning streets, flushing sewers and gutters or resulted from under-registration of meters, leaks in the distribution system or uses at the water plant.

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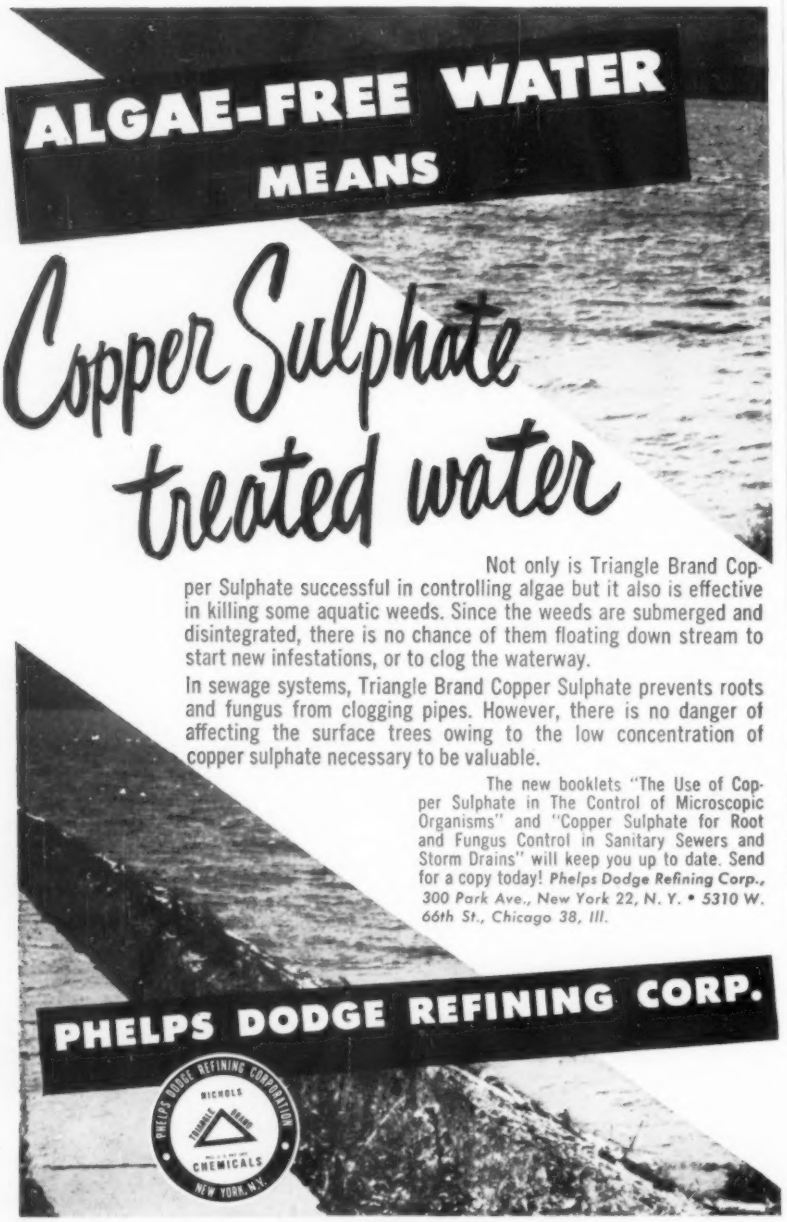
### Property Taxes Not Needed

All property and poll taxes have been eliminated in Madisonville, Ky., because of the profits received through the municipal operation of a water plant and power system.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### Sampler for Sewage and Wastes

Engineers of the Eastman Kodak Co. have developed a sampler for taking samples continuously for any desired period, and measuring and recording the rate of flow during the period that each sample is taken from a sewer or other channel. A pump draws a continuous flow of the liquid through a circulating pipe, to keep the pipe flushed and lessen the danger of losing prime, with provision for drawing off samples of the liquid into several containers in succession. A potentiometer fastened to the suction pipe records the rate of flow during each sample.

"Sewage and Industrial Waste Sampler." By W. B. Henderson, Tennessee Eastman Co. *Sewage and Industrial Wastes*, September.

### Portable Plant For 400 Scholars

Dade County, Florida has to provide schools for about 10,000 additional children a year. When September finds that not enough new schools are ready, they use portable school centers consisting of classrooms, toilet facilities and cafeterias, of which they own 19. At each site the sewage is disposed of by septic tanks and drainage fields, when a town sewerage system is not available. In one instance the soil was impermeable clay fill and a drainage field was impossible, and the school board's engineer designed a portable, all steel treatment plant that could be dismantled into units small enough and light enough to be transported over county roads. This plant consisted of an Imhoff tank and a trickling filter designed for 400 persons at 12 gpc per day with a BOD of 200 ppm. The chief difficulty was the weight of a filter filled with broken stone. Removing the stone and replacing it when the filter tank was in its new position would be expensive and the bacterial efficiency would be disrupted. To solve this problem, 1½-in. by 3-in. wooden blocks were used instead of stone. This reduced the weight by 20 tons. The total cost of this double-unit plant in place and in operation was about $17,300, which can be written off in less than ten moves.

"Portable Sewage Plant Fills in Gap Until Permanent Facilities Are Set. *Engineering News-Record*, Nov. 17.

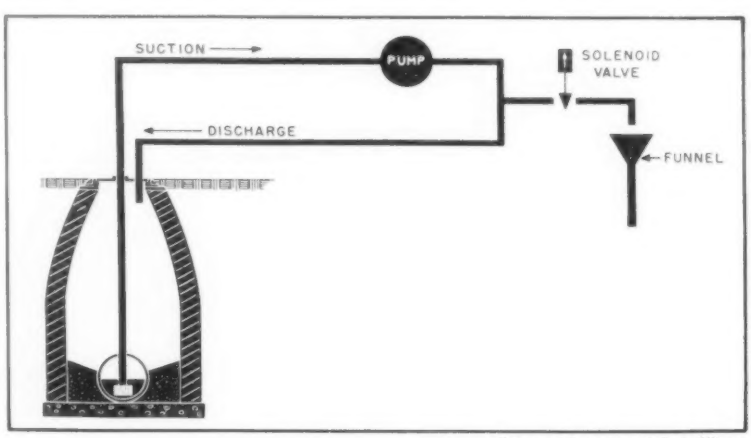
### Practical Difficulties In Refuse Reclamation

Recently the South African Council for Scientific and Industrial Research conducted a survey in connection with compost research and found that, out of 61 South African towns with a total population of 4,163,850, 49 had at some time or other produced compost, but only 27 are still doing so. Of these, 11 recovered all reclaimable and useful articles such as metals, bones, rags, bottles, etc., and the others recovered one to four items only. Of the 27, 19 produce compost at a financial loss; the other 8 believe that a small profit accrues if the cost of controlled tipping be taken into consideration. The reasons for discontinuing composting are the practical difficulties as well as the ease of controlled tipping, dumping or incineration. The practical difficulties include fly nuisance, acidity, weed seeds, heat and ventilation control, and cost. The author, town engineer of Welkom, explained the use of composting by that town as due to the fact that there were no low areas available for sanitary fill. Careful, scientific operation succeeded in eliminating most of the practical difficulties, but the compost cost 15s 2d per cu. yd. and was sold for 12s 6d.

"Practical Difficulties in Refuse Reclamation." By S. J. Mostert, Town Engineer. *South African Municipal Magazine*, September.

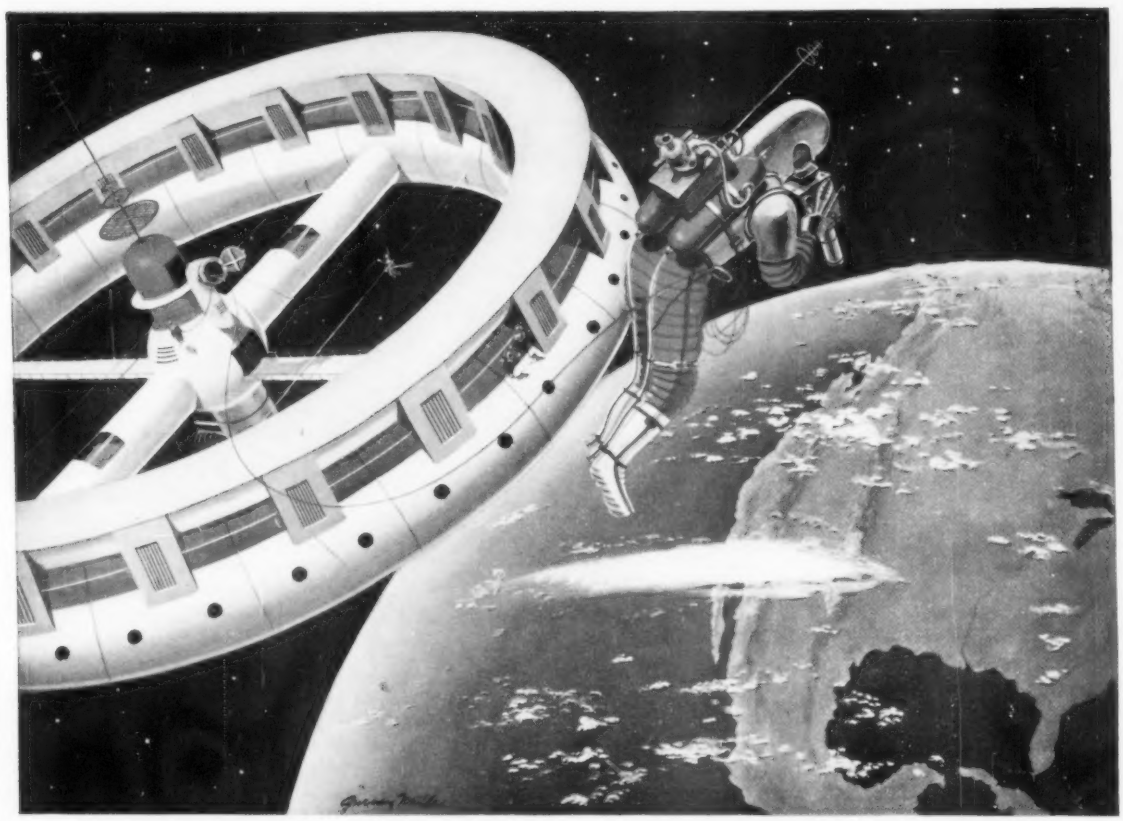
### Practicability Of Selling Sludge

In investigating the practicability of drying and selling sludge from the Mill Creek Sewage Works, the Sewage Disposal Section of Cincinnati, Ohio, questioned 25 sewage disposal plants throughout the country with populations from 35,000 to several million. Most of them reported that, because of actual experience or investigation, they believed selling sludge to be possible only at a financial loss. Milwaukee, which invested about 8 million dollars in facilities for manufacturing fertilizer and has established a market for its "Milorganite", reports that it is operating at a net loss of $7.50 a ton. The Chicago Sanitary District sells dried activated sludge




Courtesy Sewage and Ind. Wastes

● **METHOD for continuous sampling from sewer or manhole.**



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at $15.00 a ton; and while it costs $25.00 to $40.00 a ton to produce, it enables them to dispose of the sludge. Dayton, Ohio, dries the sludge in a multiple-hearth furnace and operates at "near the break-even point." The 20 mgd plant at Schenectady, N.Y. recently installed flash drying equipment and they dry and bag 50% of their total digested sludge and "market it at a profit." The superintendent of the Atlanta, Ga. plant expresses the opinion that the process would interfere with the efficiency of general plant operation.

"Cities Report Varying Success in Drying Sludge for Sale." By Arthur D. Caster, Eng'r. of Sewage Disposal, Cincinnati, O. *Wastes Engineering*, November.

### Disposal of Sewage Sludge

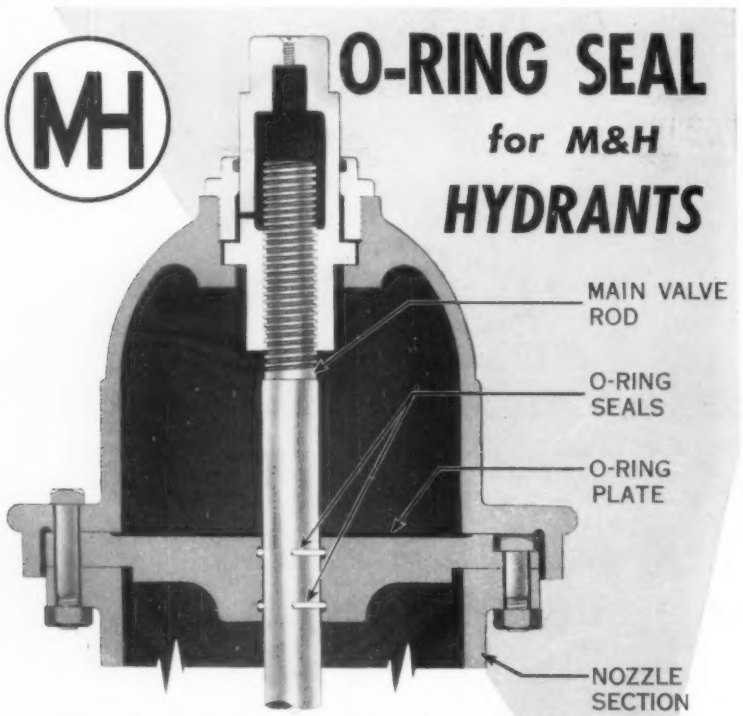
Selection of the method of disposal of sludge for a particular plant should consider the factors of sanitation; cost of equipment and operation; area available in the future as well as now; and value of sludge as a soil conditioner. The last, in the author's opinion, has not been given sufficient consideration. Treatment for this purpose involves dewatering and drying. He cites investigations of this procedure being made at Michigan State College; Waterbury, Conn., and Fond du Lac, Wis. Based on data collected at these three plants, definite operating principles of dewatering were formulated. These included: 1. Optimum rates are obtained when the drum submergence is 20 to 25% of the filter cycle, and when the drum is so operated that a cake is formed no thicker than is required for good discharge. 2. A vacuum of 20-25 in. Hg should be maintained to obtain maximum rates. 3. Careful consideration should always be given to minimize plant investment and operating costs by considering the optimum thickener-filter installation. 4. Average sludge filtration rates can be increased from 25% to more than 100% with the use of a permanent type of metal media which is self-cleaning. 5. Reductions of cake moisture of from 5 to 10% can be obtained by operating at 20-25 in. Hg vacuum vs. 10-12 in., with all other conditions held constant.

"Horizons in Sludge Disposal." By Berne A. Schepman, Director testing laboratory, Eimco Corp. *Public Works*, December.

### Philadelphia's Southwest Sewage Works

Philadelphia is engaged in constructing an $80 million program aimed to treat all the city's waste. One plant, the Southwest works is now in operation; and the last one in the program, the Southeast works, is expected to be finished in 1956. The Southwest works was designed for an average daily flow of 136 million gallons. It includes screening, grit removal, flocculation, sedimentation and sludge digestion; the digesters have capacity for sludge which will be pumped to them from the Southeast plant when that has been built. Screenings collected on 6 bar screens with 1 in. clear openings are discharged automatically onto a steel belt conveyor which takes them to pneumatic ejectors, which discharge them into a lagoon. Grit settles in 6 grit channels, from which it is removed by screw conveyors and ejectors to lagoons. Four settling tanks are designed to provide a two-hour sedimentation period. Each tank contains 7 longitudinal collectors and two cross collectors. The sludge is pumped to 8 digesters and preheated to about 100°F. Digested sludge is pumped to a lagoon.

"Philadelphia's Modern Southwest Sewage Treatment Works." *Public Works*, December.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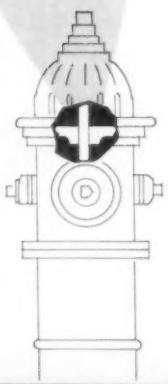

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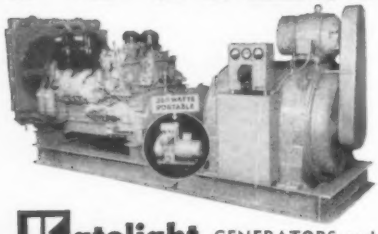

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## Sanitary Fills In Wet Areas

Sanitary fills in wet areas present problems not found in those made on dry land. In wet areas the author includes swampy or marshy land, tidal areas, and ponds or other depressions filled with water to maximum depths of about 25 ft. Fills on such lands will settle more rapidly and further because of accelerated decomposition, leaching action, subsurface subsidence and mud wave displacement. When well seasoned, they will support uniform loads of the order of 2500 lb. per sq. ft. Marshy areas should be provided with adequate drains. Fills should be made initially to a height of 5 ft. above marsh elevation to provide an area for maneuvering the vehicles. Operation should minimize the formation of mud waves. In filling a tidal area, subdivide it into several lagoons and fill one of these at a time, placing in-water layers during cold winter months only, to 2 ft. above maximum high water. Noisome leachings can be prevented by watertight sheet piling. In filling ponds, dumping into water should be confined to cold weather. Displaced water should be discharged at low velocities over weirs at as uniform a rate as possible. Actual costs of filling wet areas with over 4,000,000 tons of refuse, including cost of preparing area, equipment and operation, averaged $1.72 per ton for marsh areas and $2.12 for tidal areas.

"Sanitary Refuse Fill in Wet Areas." By C. A. Rogus, Dept. of Sanitation, New York City. *Public Works*, December.

## Tracing Sewage Discharge into the Ocean

In a study of the spreading and sedimentation of sewage discharged into the harbor region of the Oslofjord, the biological laboratory of the University of Oslo, Norway, found the use of a helicopter very advantageous. Seen from directly overhead, sea water reflects practically no light and appears almost black. But small floating particles appear lighter and larger floating objects appear quite light. Photographs taken from a helicopter therefore enabled them to trace the dispersion of the sewage on the surface. Also floats placed at the sewer outlet were more easily located than from a boat. Surface water samples were easily obtained from the helicopter; more being taken in one day than in a week from a boat. With a polarizing filter and a proper color filter, the camera will far exceed the human eye in discovering suspended matter in the sea.

"The Spreading of Sinking Particles in the Sea." By Fredrik Beyer, of the biological laboratory. *Sewage and Industrial Wastes*, September.

## Traveling Distributor At Minworth, England

Longitudinally traveling filter distributors have been installed in this country in only two or three plants, adopted from English practice of a generation ago. The latest installation of which we know was made at the Minworth plant in England, as part of a recent improvement. There, distribution had been by fixed nozzles on 8 one-acre beds. These were changed to form two 4.4-acre beds, which are used alternately as primary and secondary. Sewage is distributed onto these by means of rope-hauled distributors with spans of 56 ft. 7 in. Each is driven by a 5 hp reversing electric motor over a travel length of 112 ft. 6 in. at a speed of 40 ft. a minute. Discharge from each distributor is continuous.

"Minworth Uses Double Alternating Filtration." By M. R. V. Davies, Eng. Birmingham Tame and Rea District. *Municipal Engineer*, Nov. 4.

## Starting Sludge Digesters

The author describes in detail his experiences in starting the digesters of Cincinnati's Little Miami digestion tanks, and his conclusions as to how this can be done successfully. Results during the first nine months of operation were very disappointing; the sludge continued to be "sour." This he attributes to three major factors: 1—Failure to detect the build-up of volatile acids in the digestion system during the first 30 days of operation. 2—Misinterpretation of gas production volumes because of error in reading the gas meters. 3—Additions of raw sludge solids to the digesters far in excess of quantities desirable for starting an unseeded digester. After the ninth month, all four tanks were emptied and cleaned out, one at a time, and started all over with a new procedure which has continued successfully for a year. From these experiences with two methods, one successful and one not, he reached conclusions as follows:

In beginning operation, it may be advisable to bypass part of the raw sewage for 30 to 100 days while developing digestion under controlled reduced feed of fresh solids. The volatile acid test should be used

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when the digesters are first placed in operation as well as during the succeeding period of establishment of methane fermentation. Volatile acids in concentrations above 1800 ppm are undesirable for development of normal digestion in starting new digesters. Digesters "fouled" to the extent of 4,000 ppm or more volatile acids should be emptied and started again. The $CO_2$ of the gas produced in new tanks must be as high as 65 percent by volume during the development stages. Sharp reduction in $CO_2$ should follow once the volatile acids in the tank are converted to methane and $CO_2$. Until a normal trend has been established, feed rates of raw solids should be approximately 0.01 pound volatile solids per day per cu. ft. of digestion capacity. This may be increased later by increments of not more than 0.1 of the nominal design loading rate if the volatile acid determinations for two successive days do not show a decided increase. Seed sludge, if used in sufficient quantity, may reduce the starting period to 18 days or less; without it, the period probably will be 60 to 100 days if proper feed control measures are observed. In a well established digester, the total alkalinity should be 2,000 ppm or more; the volatile acids less than 300 ppm; the pH 7.0 or above; and the gas should contain less than 36 percent $CO_2$ by volume.

"How to Avoid Sour Digesters." By David P. Backmeyer, Supt. *Water & Sewage Works*, September.

## Los Angeles Sewage Disposal

The Hyperion treatment plant is no longer able to treat satisfactorily the increasing amount of sewage brought to it, and three plans for solving the problem have been presented by different engineers. One is to build at Hyperion a high-rate activated sludge plant with 315 mgd capacity and discharge a clean, stable effluent one mile off shore; and construct another plant discharging into the Los Angeles river. Another plan was to divert part of the City's sewage to a treatment plant now being operated by the County. A third plan was to convert the Hyperion plant to primary treatment only and discharge the effluent into deep water 5 or 6 miles from shore. The arguments for each of these plans are given in this article.

"The Two Sides of the Los Angeles Sewage Disposal Question." *Engineering News-Record*, Nov. 24.

## Designing Aeration For Activated Sludge

The capacity of an aeration system provided for any activated sludge plant should be based on the BOD to solids loading as well as on the total BOD input. Since sludge reaeration makes possible a reduction in total aeration tank capacity, and hence in volume of liquor or sludge that must be mixed and agitated, it should result in some slight saving in air requirements. In view of the many variables and unknowns involved in sewage treatment design, however, this possible saving is believed to be too theoretical to warrant consideration by the designer. The air requirements of a plant designed in accordance with the procedure herein suggested are believed to be practically the same regardless of whether sludge reaeration is provided or not.

"A Rational Approach to the Design of Activated Slude Plants." By T. R. Haseltine. *Water & Sewage Works*, November.

## Other Articles

"Treating **Brewery and Print Plant** Wastes With Sewage" at Cranston, R. I., increased cost and decreased efficiency. By Ralph W. Horne. Wastes Engineering, November.

"Getting the Best Performance from **Pre-Treatment** Sewage Plant Units." By Le Roy W. Van Kleeck. Wastes Engineering, November.

"Two Years to Go on Key **(Cincinnati) Ohio** Sewage Plant. Description of completed plants and future plans. Engineering News-Record, Nov. 10.

"Revenue Bonds **Finance Sewage Plant** Modernization" at Salem, Ohio. Public Works, December.

"**Determination of BOD** by a Reaeration Technique." By Harold L. Elmore, Chemist, S.P.C. Lab. Sewage and Industrial Wastes, September.

"Mechanics of Oxygen Absorption in Spiral Flow **Aeration Tank.**" Experimental proof of theories explained in Digest in Dec. issue of Public Works. By Henry R. King, Eng. San. Dist. of Chicago. Sewage and Industrial Wastes, September and October.

"Improving the Efficiency of Existing **Interceptors.**" By Erik Rus. Carstensen, Assoc. Eng., Buffalo, N. Y. Sewer Authority. Sewage and Industrial Wastes, October.

"**Eugene (Oregon)** Sewage Treatment Plant." By Fred Merryfield and Ralph E. Roderick, Water & Sewage Works, November.

"Waste Heat and **Sewage Gas** Utilized at York, Pa." By L. T. Tyburski, The Bristol Co. Water & Sewage Works, November.

"**Sludge Elutriation.**" For the practical sewage plant operator. By Theodore Jaffe. Assoc. Prof. of C. E., Univ. of Fla. Water & Sewage Works, November.

• • •

## Trenching Costs for Water Mains

In Little Falls, Minn., a contract for trenching for water mains was awarded on a bid of 58 cents per ft. There is no information on depth, but this is a cold area.

## Tractor-Bulldozer Unit Cleans Up After Flood

Courtesy Caterpillar Tractor Company

● **AFTER the October floods in Collinsville, Conn., a major cleanup and reconstruction job was necessary. The bridge and roadway were washed out. Height of the flood waters is indicated by the debris piled against side of building at right.**

# Contractor Takes Tractair to Church and Solves Unusual Construction Problem

Remodeling of this large church depended on plenty of air power.

"Inside" job was confined, crowded, with poor footing.

Here's how a construction firm found the answer with a Le Roi Tractair.

A self-propelled Le Roi Tractair compressor went to church recently to help a Michigan construction company with an unusual air-power problem.

**The job was different** and difficult. St. Mary's Church in Wausau, Wisconsin was to be remodeled inside, from the ground up. Plenty of air power was needed to work essential tools. But long hose wouldn't work because of friction loss and danger of abrasion from debris. Not even small trucks could get inside the building.

**To solve the problem,** a Le Roi 125 Tractair, capable of working in crowded conditions . . . maneuvering in tight corners . . . "stepping" through loose, deep sand, was driven into the church. In this way continuous air power was provided for the job, without tying up additional equipment or men.

**Ready to work at any job.** Tractair, a combination 42-hp wheel tractor and 125-cfm air compressor, can be equipped with a variety of drilling attachments, front-end loader, backhoe, rotary sweeper, backfill blade, and operates Le-Roi-Cleveland air tools — rock drills, pavement breakers, clay spades, backfill tampers.

On this job, the Tractair functioned as a specialized tool providing a complete answer to the need for dependable air power inside the church. The Le Roi Tractair was also used outside the church to break concrete, along with a portable Le Roi Airmaster compressor. On many jobs, the Tractair can replace a truck-towed compressor with a 50% saving in equipment costs and manpower — and unlimited savings in time.

(Above) Work outside St. Mary's church in Wausau, Wis., used Le Roi Tractair and Le Roi Airmaster compressor to break concrete.

(Below) Inside church, Le Roi Tractair provided air power when and where needed because it can move about in confined, crowded places.

Le Roi Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin also manufactures portable and stationary air compressors, air tools, and engines. Write today for information about any of these products.

T-48

# PUBLIC WORKS DIGESTS

# The WATER WORKS Digest

## Theoretical Study Of Sea Water Intrusion

Among the Waterworks Digest items in the December issue of *Public Works* was one entitled "Barrier to Prevent Intrusion of Salt Water," in which it was stated that the California Legislature in 1951 appropriated $750,000 to be used for investigating the subject. Of this amount, $642,000 was allocated to the experimental work described in that article. The remaining $108,000 was divided between the University of California and the U. S. Geological Survey for model tests and laboratory determinations. The Sanitary Engineering Research Laboratory of the University has prepared a report giving the results of their studies of a model, of slurry for cut-off walls, and others. The summary and conclusions of this report were published in the November issue of *Public Works*. These included methods for determining theoretically the amount of fresh water that must be injected to produce desired results under given conditions, the amount that would flow to the sea, etc. No mixture of soils and additives was found which would provide a complete seal for cut-off walls.

"Sea Water Intrusion Studied." *Public Works*, November.

## Reducing Unaccounted-for Water

Santa Monica, Calif., aims to reduce its unaccounted-for water to 3%. It serves about 77,000 citizens, deriving 90% of its supply by purchase from the Metropolitan Water District and the other 10% from wells; but the latter could supply 55% in an emergency. The program includes metering, as accurately as possible, all the water that enters the distribution system and all that leaves it; and reducing losses from the distribution system itself, and from the reservoirs. The water from the wells is measured by a venturi meter, except for two wells, which discharge through 8-in. propeller-type meters. All meters are replaced after 10 yr. service, and tested when consumers complain of low pressure. A third of the services are copper pipe, and the remainder are being changed to this. The mains are cast iron of the 200 and 250-class, and the former are being replaced with 250-class. The cement-lined reservoirs, built in 1924-25 showed fine cracks, which were sealed with bituminous paint covered with spun glass cloth. After the first year of this program, the increase in revenue exceeded the cost of the program, and the water losses had decreased to 7.2%.

"97% Accounted for." by J. R. Patten, Supt. *American City*, November.

## Photographic Records Economical and Invaluable

The Plattsburg, N.Y. water department uses a Speed Graphic camera for taking 4 x 5 negatives of all subsurface repairs and also of the location of valve and meter boxes. These are enlarged to 8 x 10 prints and the distances to reference points and directions of valve turns are drawn on these. These photographs are more economical that the cost of making accurate drawings and more readily used by workmen in the field and by other city departments.

"A Picture Record Helps City Expand Water System." By Frank Behan, Supt. *American City*, November.

## Diatomaceous Earth Filtration

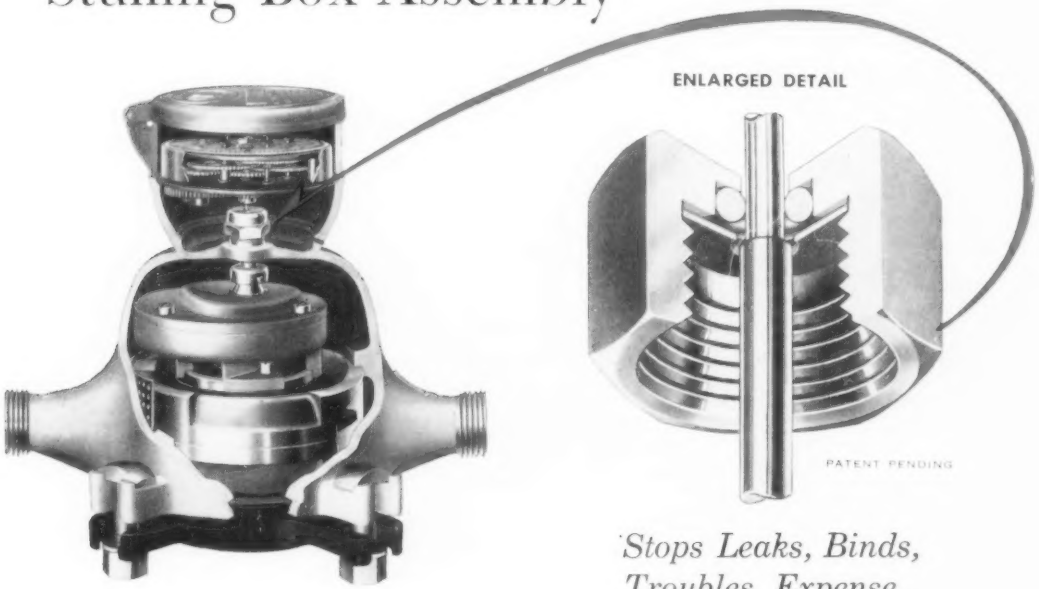
This could more accurately be called "filter-aid filtration," since not only diatomaceous earth is used as a filter aid, but also Wallastonite, expanded perlite, granular cellulose materials, asbestos fiber, activated carbon and other finely divided substances. There are several types of filter-aid filters and of filter elements. The elements include wire or plastic cloth; wire wound in grooves on a central perforated core; trapezoidal, self-spacing, stainless steel ribbon wound on a perforated metal core; porous, sintered aluminum oxide; and others. These filters are unsurpassed for removing turbidity and are efficient in the removal of algae, but are not recommended for a high degree of removal of true color due to tannic humic acids. Operating trouble may be caused by floc carry-over, iron and manganese and electrolytic corrosion. The next ten years will bring the development of new filter aids and techniques to enable these filters to be used with great saving in construction and operation costs.

"Diatomaceous Earth Filtration." By Henry N. Armbrust, Proportioneers. *Journal, New England W.W. Ass'n*, September.

## Detecting Radioactivity In Chicago Water Supply

Chicago's South District Filtration Plant has perhaps the best equipped water works laboratory in the country for measuring radioactive contamination of water. They make periodic measurement of radioactivity in rainwater and snow, daily measurements of raw lake water and of outlet water, and emergency measurements. There are two phases of daily measurements—continuous and periodic. The equipment for making a continuous and permanent record contains a Geiger tube through which water is passed continuously and which signals the radioactivity to counting rate meters, which in turn activate the recorders. Liter samples are collected every two hours and sampled as a check on the continuous monitor. For making the most precise tests, all the water is evaporated, leaving the radioactive materials which were in the water, and the radioactivity of these is measured. For measuring radioactivity of rainwater, samples of water are collected after each rain from five rain gauges. The plant has emergency monitoring

# The Rockwell "O" -Ring Stuffing Box Assembly




*Stops Leaks, Binds, Troubles, Expense*

## The Greatest Single Advance In Water Meter Construction In Years

Here's another outstanding development from Rockwell Research. It's a sure cure for all the headaches that go with meter stuffing box maintenance. Perfected four years ago, this Rockwell "O"-Ring Stuffing Box assembly has now been thoroughly field tested. *It won't leak; can't bind!* Meters with this construction run more freely, stay accurate longer. Worn spindles are a thing of the past.

Now *all* Rockwell water meters make use of this *exclusive* "O"-Ring design upon which patent application has been made. There's no extra cost for this construction, but a lot of extra satisfaction and value. Ask your Rockwell representative to demonstrate. And be sure to inquire about the use of "O"-Ring stuffing box nuts as interchangeable replacements for stuffing box assemblies in earlier model Rockwell meters.

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ROCKWELL

## ROCKWELL WATER METERS

*A Size and Type For Every Kind of Service*

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equipment supplied with current from its own batteries, which can be used where or when no outside power is available.

"What the South District Filtration Plant Is Doing to Detect Radioactivity in Our Water Supply." By Robert W. Schmidt, Chemist of the plant. *Pure Water*, September.

### Public Services For Suburban Areas

The October issue of the Journal of the American Water Works Ass'n. contains several articles dealing with the problems, largely financial ones, involved in providing water and other public services for areas outside of city limits. Under the head of Federal Aid, John C. Hazeltine, Com'r., Community Facilities Administration, discusses housing finance, slum clearance, and advance planning. His Administration has available much aid for states, municipalities, and public bodies, and will provide federal funds on a business arrangement for the construction of needed public works. In August, 1955, $48,000,000 of federal funds became available for public works planning. Applications for such loans should be made to the Housing and Home Finance Agency regional office for the area.

The control and assistance of the Public Service Commission of Wisconsin in providing water and other public services for suburban communities are described by Orville P. Deuel, rate analyst of the commission. The sanitary engineering viewpoint of the problem is presented by Willard F. Shephard, Engineering Director of State Dept. of Health of Michigan. The necessity for fire protection in suburban and other small communities is discussed by Kenneth J. Carl, of the National Board of Fire Underwriters.

In summing up the discussions, Abel Wolman calls attention to the laws of Virginia relative to annexation of suburbs by cities which substitute an orderly judicial procedure for the emotional approach, and have resulted in more annexations than, perhaps, in any other state. The increased demands for water resulting from growth of population and of legitimate uses must be met by water utilities and not by subdividers, who should not be asked to serve as bankers in providing such utilities.

Appended to the article are Excerpts from Wisconsin Statutes on Extensions and Sanitary Districts, and Extension Rules of the Public Service Commission.

"Extension of Public Services to Suburban Areas. Panel Discussion." *Jour., Am. WW Ass'n.*, October.

### A Management Program By Industries Is Desirable

Industry now requires 75 bgd from surface streams and 6 bgd from wells. The total domestic consumption is 14 bgd. Industry is largely responsible for the present and impending water shortages, and should take measures to reduce its consumption. Water management not only can effect this in many cases, but can also prove economical. General Electric Company is saving over $100,000 a year by carrying out a complete program.

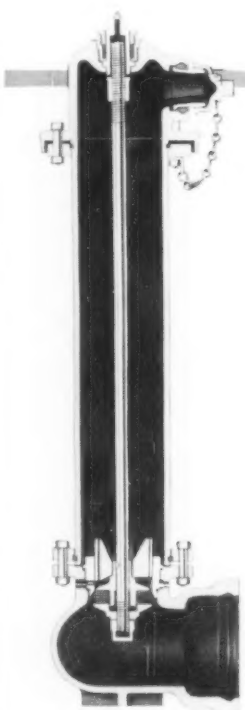
"Need for Water Management Program in Industry." By K. S. Watson, General Electric Co. *Jour. Am. WW Ass'n.*, October.

### Asphalt Lining For Rutland's Reservoir

An 85,000,000-gallon reservoir was put into service at Rutland, Vt., in 1954, formed by a dam 355 ft. long and 42.5 ft. high above the natural ground level; up-stream slope, 2½ on 1. Sod and loam were removed


# HIGH QUALITY HYDRANT

*The R. D. Wood Standard Swivel Joint Hydrant with or without breakable flange and stem coupling*

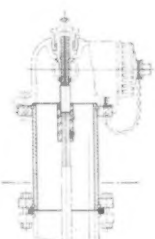


*All Bronze Stuffing Box*

Sound and simple in construction. It cannot rust or corrode. Hydrant operating thread can be greased or oiled by unscrewing one small plug.

*Extension Piece*

Can be inserted between hydrant head and barrel or between barrel and elbow. Installation does not require shutting off water supply.



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from the entire 67,000 sq. yd. of basin surface, which was raked and rolled and covered with asphalt. The asphalt was applied at the rate of 2 gal. per sq. yd. giving a minimum thickness of 0.2 in. It was placed in two or three separate applications to insure against pin-holes through the finished membrane. It was covered with 12 in. of sand and fine gravel, with an additional 12 in. of stone riprap on the face of the dam. The asphalt used was a special product which gives a tough, flexible and durable film. It differs from road asphalt in that it does not penetrate the dirt subsurface and is applied at 400°F.

"New Asphalt-Lined Reservoir for Rutland, Vermont." By Edward L. Tracy, Vermont Dept. of Health. *Journal, New England WW Ass'n,* September.

### Charges for Fire Protection

Nothing like unanimity of opinion appears in fifty replies to a questionnaire on this topic. New Haven, Conn., Water Co. makes a yearly charge of $0.0053 per inch-foot of mains, plus $14.40 per public fire hydrant. The Eau Claire, Wis. Water Dept. receives from the city $15 per hydrant plus 7 cts per lineal foot of main. At Manchester, Conn., there is a $10 hydrant charge plus 1 ct per inch-foot of main. At Des Moines, Ia., the city pays the department an annual lump sum based on $60 per mile of mains. Omaha pays $0.004 per $1.000 of assessed valuation. For private fire connections, the average charges of the fifty replies are $26 per hydrant; 19 make no charge; 12 favor metering fire connections and 29 do not.

"Charges for Fire Connections." *Water Works Engineering,* November.

### Other Articles

**Cleaning and lining** a main in Anson, Tex. "How We Kept Our City Wet." By J. C. Duff, Mayor. Public Works, December.

"**Mechanical Joint** Cast-Iron Pipe." By Thomas F. Wolfe, C. I. Pipe Research Ass'n. Jour., N.E.W.W. Ass'n, September.

"New and Interesting Features in Relation to **Gravel-Packed Wells** and Pumping Plants" at Provincetown and Centerville-Osterville, Mass. By Paul F. Howard. Jour., N.E.W.W. Ass'n, September.

"Maintenance of **Steel Water Works Tanks.**" By George A. Sampson; Allen M. Symonds, Gen'l Eng. & Construction Co.; Charles J. Gotthardt, paint manufacturer; and Roy O. Leonard, painting contractor. Jour., N.E.W.W. Ass'n, September.

"Establishing **Rates and Service Charges** at Manhattan, Kansas. By W. B. Avery, City Mgr. Jour., A. W. W. Ass'n, October.

"**Water Resources Policy** for the State of Washington." By W. A. Galbraith, State Dept. of Conservation and Development. Jour. A.W.W. Ass'n, October.

"**Safe Working Practices.**" Part 3 of the AWWA Safety Manual. Jour., A.W.W. Ass'n, October.

"**Meter Maintenance** Increases Revenue." By M. O. Hazlett, Neptune Meter Co. Water & Sewage Works, November.

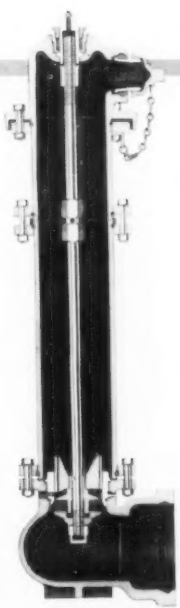
"**Rubber-Lining a Large Reservoir**" at Newcastle-Upon-Tyne, England. By A. G. McLellan, Eng. & Gen. Mgr. Water & Sewage Works, November.

"Water Works Practice: **Coagulation.**" By George E. Symons. Water & Sewage Works, November.

"Designing, Constructing and Maintaining **Centrifugal Pumps.**" By Roy Carter and Igor J. Karassik, Worthington Corp. Water & Sewage Works, November.


**AT LOWEST COST**

*The R. D. Wood Standard Swivel Joint Hydrant* is designed to provide maximum strength and reliability at lowest possible cost. Internal friction, which can lower pressure, is reduced to the minimum, well below A.W.W.A. specifications. Changes of diameter are carefully rounded and nozzleways are scientifically tapered.



*Breakable Flange and Stem Coupling*

Available at slight additional cost are this specially designed flange in the standpipe and a frangible coupling in the hydrant stem. A heavy blow that would ordinarily break the hydrant will snap the ring in the flange and the coupling in the stem. Both can be replaced quickly and inexpensively. No digging is necessary.

Exterior views showing breakable swivel flange and head with steamer nozzle and two hose connections. Available with standard types of pipe connections—bell, *mechanical joint,* flange, universal or screw.

**COMPANY**

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

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# Developments in Sewage Treatment at Minneapolis-St. Paul

THE sewage treatment plant of the Minneapolis-St. Paul Sanitary District, placed in operation in 1938, provides removal of screenings and grit, sedimentation, and disposal of sludge. The degree of treatment required varies from time to time with the amount of dilution afforded by the Mississippi River and the characteristics of the river water as it reaches the plant outlet; the aim is to maintain satisfactory sanitary conditions in the river. Samples of the river water are collected at regular intervals at seven stations above the plant outlet and 16 stations below it, covering a stretch of the river 93 miles long. Due largely to this constant surveillance of the river and the adjustment of the treatment given by the plant to correspond with the conditions of the river so ascertained, the average dissolved oxygen content of the river water during 1954 remained well above the minimum required standards. During the critical summer months the DO averaged 8.45 ppm, compared with 4.70 before the plant went into operation; and the BOD averaged 2.30, compared with 4.40 previous to plant operation.

The operation of the plant in 1954 remained the same as before except for a few important changes. One of these was the use of waste carbide lime slurry instead of pebble quicklime, which began in April, 1954. The slurry, as delivered in a tank truck, contains 25 to 30 percent solids which averages 68 to 72 percent CaO. Storage was provided at the plant for 25,000 gallons. From this, 3,000 to 5,000 gallons per day are fed through a diaphragm slurry pump. The cost of the slurry is $12 per ton of CaO, while that of pebble quicklime was $17.87. In addition to this saving in cost, the slurry is easier to handle and feed. It appears to be as effective as the pebble quicklime.

The sludge is disposed of by concentration, filtration by vacuum filters, and incineration. Beginning November 4, 1954, all of the sludge was filtered through a new filter medium, 32 x 32-mesh cloth woven from 10-mil monofilament Saran plastic yarn. This cloth is relatively more porous than the closely woven 8-oz. canton flannel which had been used in the plant since it began operation in 1938. This cloth eliminated most of the blinding difficulties which have been increasingly troublesome during the past few years.

During the period November 1st through the 4th, six of the eight vacuum filters were fitted with Saran filter cloths. Laboratory tests were performed under actual operating conditions by comparing cake production from the Saran covered filters with that of a similar filter equipped with a new canton flannel cotton filter cloth. Results of these tests indicated the following:

a) Production per filter averaged about 10 percent more dry tons for those covered with Saran cloths compared to the regular cotton cloth.

b) Saran filter cloths required less washing periods than the cotton cloths.

c) Saran cloth was not nearly as subject to conditioned sludge variations as the cotton cloths.

d) Saran cloth produced a filter cake which was uniform over the entire face of the filter compared to spotty cake production of the

This 40 page book gives useful information, charts, data and instructions on water meter testing. Should be in every meter shop. Available on request without charge or obligation.

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FOR BETTER WATER SERVICES FORD

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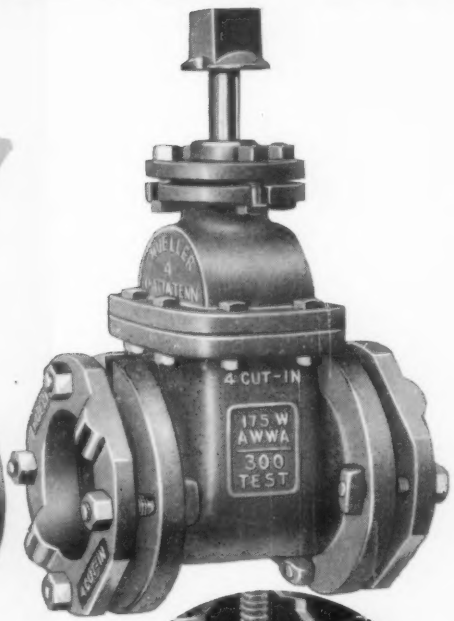
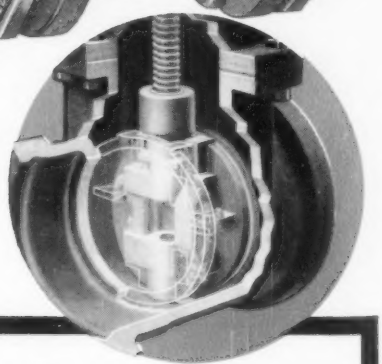
## *at low cost!*

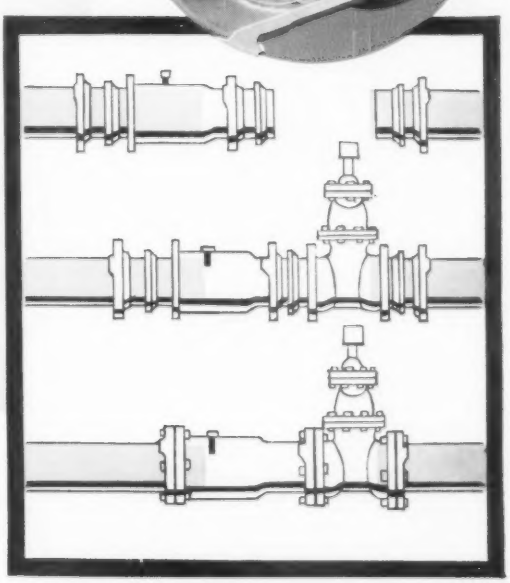


You can add needed control valves on 4", 6", 8", 10" and 12" cast iron mains quickly, easily and at low cost with the Mueller Cut-In Sleeve and Valve.

Both the sleeve and valve are equipped with mechanical joint to give permanent connections in a minimum of time. A Cut-In Sleeve and Valve of a nominal size will fit all classes of pipe in that size range, by using a specific type of end gasket. A variety of types of end gaskets are available for all classes of pipe.

The Mueller Cut-In Valve is available with conventional packing or "O" ring stem seals. The exclusive Mueller four-point disc wedging mechanism exerts seating pressure near the perimeter of the discs – prevents disc deflection and assures positive shut-offs. Consult your Mueller W-96 Catalog, your Mueller Representative, or write direct for complete information.



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*Dependable Since 1857*

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

cotton cloth, due to the latter becoming easily "blinded" from embedded sludge particles and excess chemicals.

e) Filter speeds could be appreciably increased with the Saran cloth filters, with no loss in filter cake production, while the same did not hold true for the cotton cloth filter under the same operating conditions.

With all of the conditioned sludge being filtered through the Saran cloths for the last 58 days of 1954, the following operating results were noted:

1. The iron coagulant dosage requirement was drastically reduced from an average of 2.25 percent ferric sulfate as Ferri-Floc, equivalent to 1.30 percent $FeCl_3$, based on the dry sludge solids for the first ten months of 1954 using cotton cloths, to an average of 0.88 percent ferric sulfate as Ferri-Floc, equivalent to 0.51 percent $FeCl_3$, for the last two months of the year with Saran cloths.

2. The lime requirements also showed a slight decrease from a ten-month average of 3.28 percent CaO to the last two months average of 2.97 percent CaO.

3. Where the time interval between washing periods with cotton cloths was one hour, it was found that this could be increased to a two-hour interval with the Saran cloths. This effected labor, power and water economies.

Other advantageous factors developed through the use of these Saran cloths. One of the most significant developments appears to be the increased life of these cloths. Where formerly the cotton cloths gave a service life of only 400 to 500 hours, with an acid bath or two between 150 and 300 hours to remove cloth "blinding", the sludge was still being filtered through the eight original Saran cloths at the close of 1954. At that time the average life of the six cloths installed early in November was 1,252 operating hours, ranging from 1,217 to 1,317 hours.

A definite change in the sludge filtrate solids content was noted when the Saran cloth was used. The total solids of the filtrate increased from 3,700 ppm to 4,300 ppm; the suspended solids content increased from 160 ppm to 1,600 ppm, but this increase appeared to be mostly of an inorganic nature. The Saran cloth produces a wetter filter cake, averaging 71.6 percent moisture, compared with 69.4 percent for the first ten months of the year; this necessitated some adjustments in the operation of the incinerators.

It was planned to further reduce the use of sludge conditioning chemicals with the ultimate aim of eliminating them altogether at some time in the future.

• • •

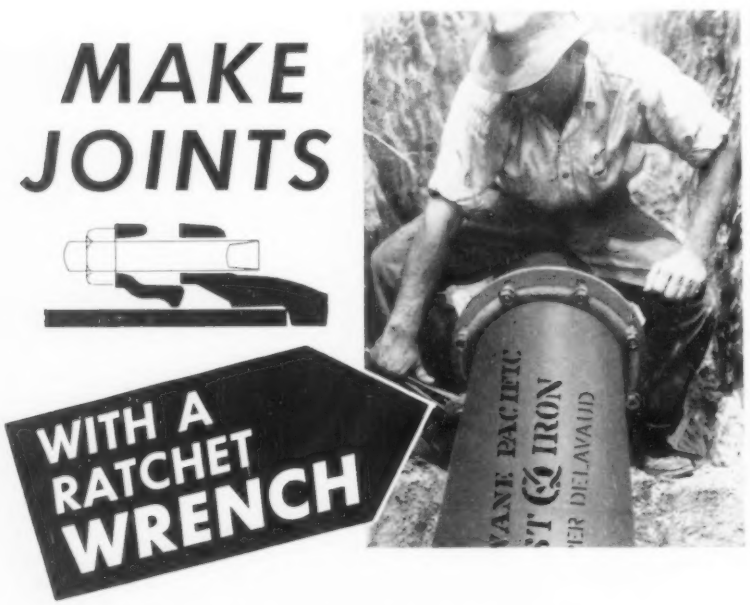
### Buildings Get Old as Well as Folks

Studies by the Cleveland, O., planning commission revealed that approximately 38,000 dwelling units, mostly in the central area of the city, should be classified as being beyond saving and should be razed. The plan commission reported that 89 percent of the dwellings in Cleveland are more than 25 years old and 65 percent more than 35 years old. Fix-up costs have been estimated at between $500 to $5,000 per unit.

• • •

### Three Newspaper Pages to Wrap Garbage

A recent ordinance in St. Paul, Minnesota is reported to require that at least three pages of ordinary newspaper be used for wrapping garbage.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MECHANICAL JOINT CAST IRON PIPE

Mechanical Joint has rapidly become the leading type joint for cast iron pipe for water or gas. A McWane-Pacific Boltite mechanical joint pipe line can be laid fast by untrained workmen, using only a ratchet wrench to make the joints. No lead pot, no calking tools.

The Mechanical joint is designed on the stuffing box principle—a thick rubber-compound gasket, triangular in cross section, being compressed by a bolted gland or follower ring. The joint is bottle tight, but flexible to allow settlement, expansion or contraction of the pipe line. Mechanical joints are interchangeable with fittings, valves, hydrants and pipe made by all leading manufacturers.

For complete information, wire or write McWANE CAST IRON PIPE COMPANY, Birmingham, Alabama, or PACIFIC STATES CAST IRON PIPE COMPANY, Provo, Utah. (Sales Offices in principal cities.)

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# SLUDGE PUMP STOPPAGES ELIMINATED AT SAN LEANDRO

## by **WEMCO** the sewage pump that never clogs

**The installation of WEMCO Pumps** at the sewage treatment plant in San Leandro, California, has completely eliminated down time on sludge transfer service. Previous down time losses amounted to 4 to 6 hours daily. These WEMCO Torque Flow Solids Pumps replaced plunger type pumps that had been having several stoppages per day.

San Leandro's sewage treatment plant has a special problem created by cannery wastes. During the last canning season, the WEMCO Pumps proved themselves by handling the increased sludge load without once clogging.

What had been a troublesome pumping job requiring extra maintenance labor and operators' standby time has now become a simple, trouble-free, almost forgotten routine.

**Because the Wemco Torque-Flow Solids Pump can solve pressing and aggravating problems in your city's sewage handling and treatment, you need the full facts. Wemco's simple "never clog" principle is fully explained in available literature. Write today for your copy.**

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# PUBLIC WORKS DIGESTS

## The HIGHWAY AND AIRPORT Digest

### Report on Asphalt Road Tests

A report on the effects of heavy trucks on asphalt roads has been issued by the Highway Research Board, on the basis of tests made by the Western Association of State Highway Officials in 1952-1954. These indicated that single-axle loads of 18,000 lb. caused less distress than 22,400-lb. loads; and 32,000-lb. tandem-axle loads less than 40,000 lb. A lesser number of applications of the tandem-axle loads produced distress equivalent to that resulting from a greater number of comparable single-axle loads. The tests were made on two thicknesses of plant-mix asphaltic concrete—2 in. on a 4-in. base of ¾-in. maximum crushed gravel, and 4 in. on a 2-in. base course of the same gravel. The latter stood up far better than the former. The 4-in. surface should have 14 in. minimum thickness of built-up pavement for the outer wheel path for 40,000 lb. tandem axle loads, and 10 in. for the inner wheel path.

"Road Test Again Puts Truckers on the Spot." *Engineering News-Record*, Oct. 27.

### Slurry Seal Coat On California Highways

Not satisfied with the use of the conventional type of seal coat on its highways, the California Div. of Highways has been experimenting with slurry or squeegee seal coat as used by the County of Los Angeles. This consists of mixing a fine sand or crusher dust with mixing-type emulsion and water to form a very wet slurry, mixed in an ordinary transit-mix truck, 25 gal. of water and 47 gal. of emulsion (65—85 pen base), and aggregate of which 91 percent passes a No. 30 sieve. This is then pored into a spreader box equipped with a squeegee strike-off rubber, which forces the slurry into all cracks and depressions as the box is drawn behind the truck. Ordinarily traffic can use the treated surface in 1½ to 3 hours. This treatment "does an excellent job of crack sealing and provides what appears to be a very satisfactory nonskid surface. The mixture is cheap and can be applied at an amazingly fast rate." It sticks tenaciously to the old pavement.

"Slurry Seal Coat." By Merle L. Nelson, Hwy. Eng. Associate. *California Highways*, October.

### Thin Concrete for Light-Traffic Roads

In 1936 a concrete road was constructed in Greene Co., Iowa, only 6—8 in. thick instead of the normal 7—10 in., and it is still one of the finest pieces of highway in the county. Encouraged by this, the county in 1951 laid two miles of test road with three different thick-

## Protection for Motorists on Hillside Streets

HILLSIDE streets created a problem for the city of Berkeley, Calif. Sharp embankments created a constant hazard to motorists and at several locations the accident rate was high. A thorough study was made about three years ago, and since then more than two-thirds of a mile of Armco Flexbeam guardrail has been installed at the danger spots. These guardrails are painted white for good visibility. The guardrail installations cost some $14,000, but have well demonstrated their worth.

A 1630-foot installation of guardrail was made on Tunnel Road by the State Division of Highways in 1953. Here the street is on two levels. In other places 24 separate installations were made by the city. These range in length from 15 feet on the west side of The Circle at Los Angeles Avenue to 175 feet on the west side of Euclid Avenue.

According to Assistant City Manager William Hunrick, Jr., the chief functions of the guardrail are to mark the limits of safe travel, warn of danger, and keep a car out of control from plunging over the down-hill side of the street. He further said that the city's experience shows that "these purposes are being met and the program is serving an important need at a reasonable cost." Cost per foot of the 24 installations was $4.47 in place.

nesses—4½ in., 5 in. and 5½ in., at bid prices of $3.04, $3.15 and $3.26. (They estimated that a 6-in. pavement would cost $3.38). This test section has come through two bad springs surprisingly well, and carried such traffic as hauling 70,000 tons of base material in a 30-day period.

Before laying this test road, load-bearing tests and soil borings 4 to 6 ft. deep were made. In soils showing a high water table or high moisture susceptibility, vertical sand drains were placed 6 ft. deep spaced 5 ft. apart, backfilled with washed sand and a solution of calcium chloride. The object of these was to afford the ground water an easier and faster avenue for rising and falling during the spring, and providing planes of weakness in the undergound ice films.

"Surfacing for Light-Traffic Roads." By C. Arthur Elliott, County Eng. *Public Works*, December.

### Television For Traffic Control

Detroit, Mich. is trying television as an aid in traffic control on expressways. TV screens pick up traffic on closed circuit cameras along the route. A monitor located in a downtown building can, if trouble develops, determine whether to send an ambulance, fire truck or control car, and do so promptly. Also, it can send instructions to ramp controls to prevent additional traffic from coming onto the expressway In making the tests, the Michigan Bell Telephone is working with the Dept. of Streets & Traffic. The director of that department considers the experiment "encouraging and favorable." The cost of including such service in the overall traffic control plan is estimated to be above $2,000,000.

"Television for Traffic Control." By Edward Janicki. *Public Works*, December.

### Virginia's In-Service Training Program

In 1945 Virginia drew up a four-year training schedule for engineering graduates. It has paid off as an incentive to attract graduates to the department, and as a medium to bring them to greater productivity in as short a time as possible. An engineering graduate enters upon a 4-year on-the-job schedule that gives him work experience while he is earning his keep by filling a regular job. He advances in succession through survey party work, location and design, bridge work, test-

# Sherman Digger-Loader "The Most Economical Device Our City Owns"

*—Mr. Raymond Hadley,*
*Supt. of Maintenance, LaGrange, Georgia*

Mr. Hadley's enthusiastic endorsement of the Sherman Digger-Loader combination has a basis in fact! In one two-week period, his men excavated for laying 100 feet of 24" concrete pipe, 400 feet of 15" concrete pipe, helped keep streets in top shape by keeping the patching trucks loaded with material, dug bellholes and did general clean-up work and repairs . . . amply demonstrating the versatility of this thrifty combination, and offering proved economies to the city of LaGrange.

The Sherman Power Digger digs as deep as ten feet in mud, hardpan, shale, oiled roads, blacktop and stony roads. Both the Digger and the Sherman Front End Loader are designed to work hard with a minimum of maintenance. The Loader is available in two models . . . with bucket capacity up to 2,500 pounds and breakaway capacity up to 4,500 pounds. You can save *your* city money, too. See your local Ford Tractor Dealer today for a demonstration or write for free Bulletin No. 529.

*Designed, Engineered and Manufactured Jointly by Sherman Products, Inc., Royal Oak, Michigan. Wain-Roy Corporation, Hubbardston, Mass.

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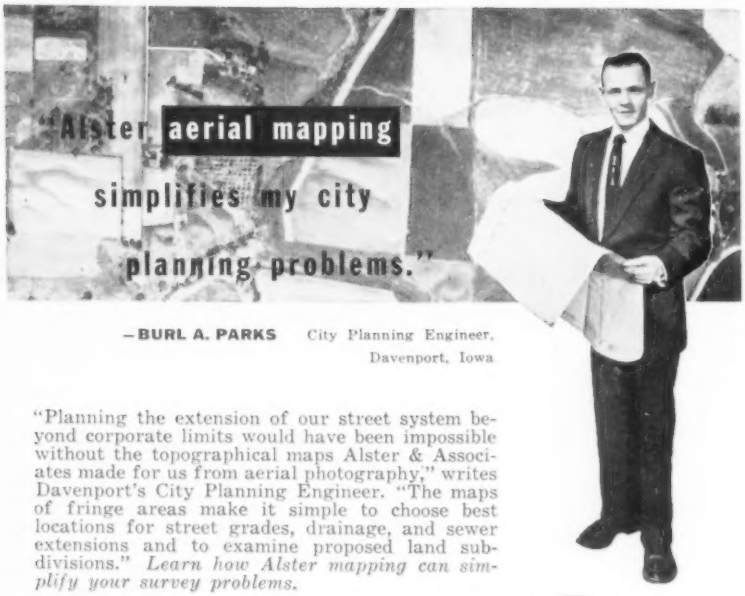


—BURL A. PARKS City Planning Engineer, Davenport, Iowa

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## ALGAE OF IMPORTANCE IN WATER SUPPLY

BY C. MERVIN PALMER & CLARENCE M. TARZWELL

This major article appearing in the June issue of PUBLIC WORKS, prepared in close collaboration with U. S. Public Health service authorities, includes for the first time in magazine history, full and accurate color plates for the identification of types of algae most important in water supplies—those which cause tastes and odors, clog filters or are likely to be found in clean or polluted waters. Color plates of this quality have never before been available to simplify the job of algae identification.

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ing, inspection, and finally service as resident aid engineer. Meantime he draws a salary increasing from $328 at the start to $410 at the end. Some 30 men have finished the program since 1950 (about half of those who began the course) and are still with the department; and 40 more are in various stages of the course. Details of the program are given in the article.

"Virginia's In-Service Training Program." By Duane L. Cronk, *Roads and Streets*, November.

### Paving Plant Inspectors Should Be Materials Engineers

The foremost and primary consideration of a plant inspector should be the evaluation of the materials which are to be used, and a revaluation of the completed pavement mixture as it is produced, based on physical tests. Four control tests are advocated: the sand-equivalent test; centrifuge kerosene equivalent test; wash sieve analysis (perhaps the most important); and the asphalt extraction test. A policy of furnishing adequate test data to the inspector, and of training inspectors in test analysis, is an important management function of the highway department. Checking the operation of the mixing plant itself need take very little of the inspector's time.

"Paving Plant Inspectors or Paving Materials Engineers?" By Merle L. Nelson, California Div. of Highways. *Roads and Streets*, November.

### Constructing a Cement-Treated Base

Probably the largest single contract for cement-treated base ever let is that for a 13.1-mile section of dual highway between Sacramento and Roseville, California. The main roadway has an untreated base layer 4 in. thick under the pavement and extending shoulder to shoulder; an 8-in. by 25-ft. cement treated base; 3 in. of dense graded hot mix asphaltic concrete 24 ft. wide, placed in two layers and topped with hot mix; and asphaltic plant-mix shoulders. The treated base has 4½ percent cement content. For delivering the 400,000 tons of aggregate, the contractor uses 4-axle, dual-tired tractor trailers that carry 25—28 tons per load. Untreated base rock was deposited on the grade in measured windrows, using calibrated spreader boxes, and rolled with 12-ton, 3-wheel steel rollers and a 13-ton pneumatic roller, sprinkling to maintain 12 percent moisture. Before placing the cement-treated base, the shoulders were built up,

compacted, and trimmed to serve as a template. Aggregate for the cement-treated base was dumped on the roadway area in two carefully measured windrows each containing 8.88 cu. ft. per running foot, and a third 5.5 cu. ft. windrow was dumped on the shoulder. Cement was spread on the windrows by a tanker that straddled the windrows, 32 lb. of cement per foot on the larger windrows and 20 lb. on the smaller. The larger windrows were mixed with two tractor-drawn roadmixers, the shoulder windrow by a self-propelled one; all three working abreast. In spreading a windrow, two motor graders, facing in opposite directions, started in the middle of a 500-ft. stretch and worked away from each other; then backed to the starting point and made a second pass, never turning around on the windrows. After this mixing of the windrows, they were sprinkled and rolled, rolling being completed within two hours after mixing.

"Record Cement-Treated Base Job." *Roads and Streets*, November.

### Trails for Hikers Provided by Government

Five long-distance "paths for walkers" have been constructed in Wales by the National Parks Commission. The latest is about 168 miles long, from Prestatyn to Chepstow. About 45 miles is on new rights of way. The route has been chosen as one most attractive to walkers while causing the minimum amount of inconvenience to farmers and landowners.

"Path for Walkers in Wales." *The Surveyor*, Nov. 5.

### Tire-Maintenance By County Saves Money

Van Buren County, Mich., has developed a tire-maintenance program which has greatly reduced the cost of maintenance. The largest single item in maintaining a fleet of more than 75 rubber-tired units was tire replacement and repair. They now purchase a premium-type carcass, preferably of nylon cord, instead of cheaper ones. Traction-type tread of extra-ply construction is used on rear dual wheels, recapped with crude rubber camelback. Road service, tire repair, matching, branding and recapping are done by a contractor, who does 95 percent of all mounting and demounting of tires. Drivers check air pressure once a week and "thump" their tires each morning. An important maintenance feature is proper mating of dual tires; when a flat

**Trenching 7 miles of street,** this Jaeger "125" Roto ran two 80 lb. breakers to line-cut and break a 7" top of asphalt over brick—averaged 1200 sq. ft. per 8 hr. day—used only 1½ gals. of fuel per hr.

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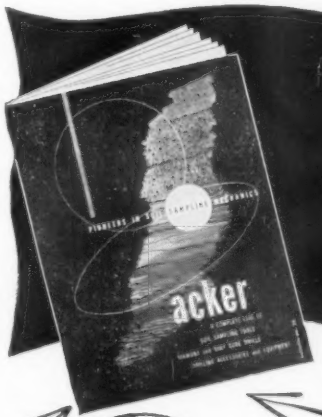


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SEAMAN TRAV-L-PLANT and PULVI-MIXER build better road bases through faster, more thorough, accurately controlled in-place mixing — a normal production rate of up to A MILE A DAY of 22-foot road! Exclusive advantages include: Mixing for *all* types of stabilization including bituminous, soil-cement, gravel, or chloride, both sodium and calcium. Blending and properly placing aggregates and fines for more durable, higher loadbearing bases. Completely correcting aggregate segregation. Mixing, blending and finishing to final grade, partially pre-compacted ready for final rolling.

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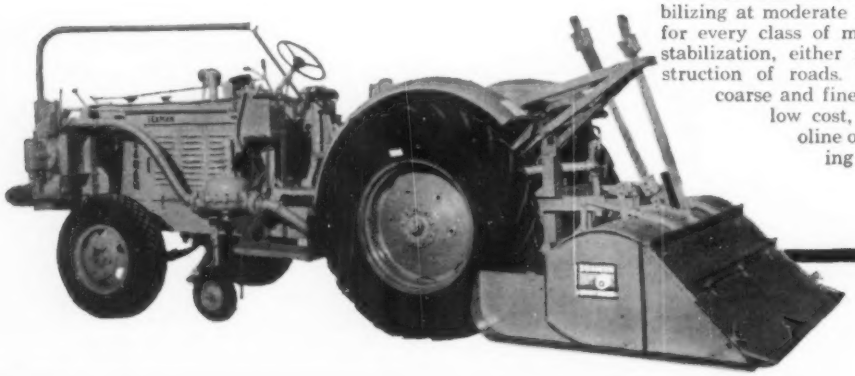
Designed for highly accurate application of all binders, including water and bitumen, simultaneously with mixing operations. Equipped with pump, spray bar, tachometer assemblies, volumetric meter. All operating controls within quick easy reach. A perfect, *all-process* machine for economical mix-in-place operations. 7-foot mixing width, gasoline or Diesel powered.

## SEAMAN SELF-PROPELLED PULVI-MIXER

The stabilization "workhorse" for all types of stabilizing at moderate investment. Widely accepted for every class of mixing and processing of soil stabilization, either new construction or re-construction of roads. Delivers accurate blend of coarse and fine aggregate — for all-weather, low cost, long-wearing surfaces. Gasoline or Diesel powered. 7- foot mixing width.



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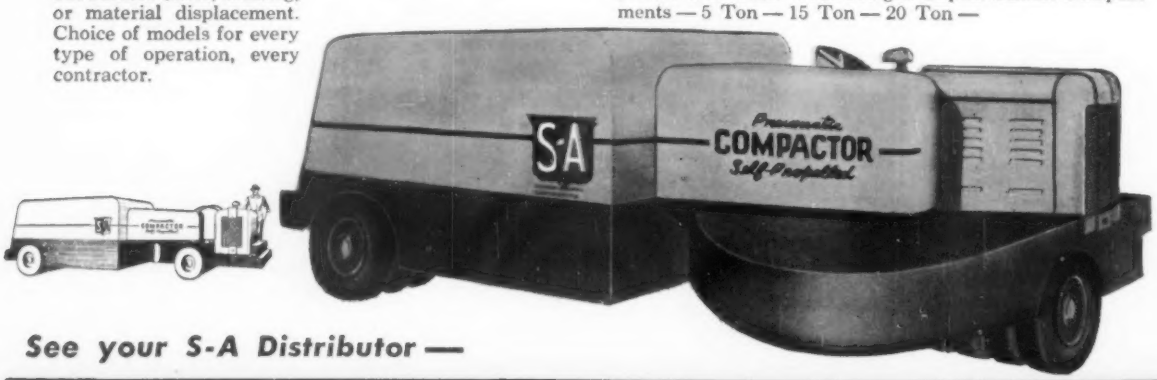


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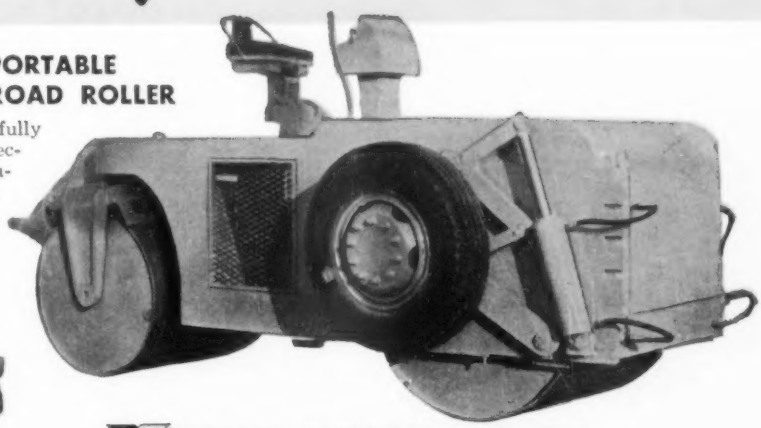
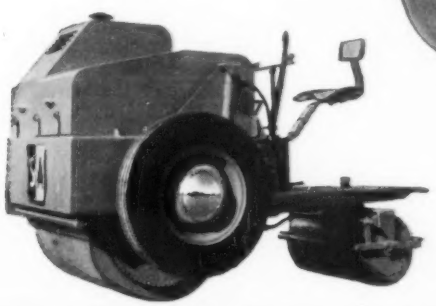
The first portable 10-ton Roller that is fully automatic, can be made portable in 90 seconds, and provides easy one-man operation. Equipped with 61 H.P. engine, fuel-saving TURBO-TORQUE drive. Hydraulically lowered trailing wheels are hinged and removable for rolling close to vertical obstruction.





## SEAMAN-ANDWALL PORTABLE TANDEM 2-3 TON ROLLER

Highly maneuverable, compact, versatile, "one-man" Roller, designed for a wide variety of jobs. Gasoline powered, with compaction roll designed for liquid ballast. Hydraulically lowered pneumatic tired wheels for easy trailing and transport. Wheels removable for close-up rolling to avoid hand work.

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There's a SEAMAN-ANDWALL Spreader for every need, in models and sizes to fit every road-building budget. Each one has unique advantages and features to meet specific requirements — in all types of materials, in daily production, and in accuracy of volume and placement.

## HERCULES CEMENT SPREADER

Heavy duty spreader for soil-cement paving. Auto-type differential provides efficient transfer of power, hand-lever controlled. Has strike-off bars for accurate quantity control up to 10-foot width. Dual Pneumatic tires for traction. Easy to attach, requires no special tail gate.

## CENTURY CEMENT SPREADER

A new idea in spreader design, providing absolute accuracy in cement spreading. Positive volumetric control of cement governed by free-running tachometer wheel which cannot skid or slow down. One-man remote operation from truck cab.

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The SA Century "Posi-Feed" Model HY-4 . . . Demountable tray for seal coating can be replaced with spinner for spreading sand or chlorides. Vibratory mechanism in the truck body maintains steady movement of materials to avoid uneven distribution. Eliminates hand feeding from truck body. One man operation.

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# ONE-MAN D Tournapull

## Speeds landfill garbage disposal

### 1. Excavates trenches

One man and one machine to handle all operations on city landfill disposal dump — that's the D Roadster Tournapull story in a nutshell. The self-propelled, rubber-tired Roadster uses both a 7-yd. Scraper and a Bulldozer for fast excavating, hauling, spreading, and leveling. This handy 122 h.p. combination digs disposal ditches of any length and size . . . or utilizes gullies to reclaim eroded areas.

### 2. Spreads, compacts, covers garbage

As garbage is trucked in, the versatile Roadster dozes it into place. Normal travel of the rubber-tired rig, back and forth in the trench, solidly compacts the refuse into minimum space. For sanitary sealing, D Tournapull covers the garbage by one of two methods: (1) dozes dirt down from the trench walls, or (2) hauls in dirt as it excavates next parallel disposal ditch. Big 18.00 x 25 low-pressure tires, torque-proportioning differential, and positive power steer help the "D" keep ahead of trenching and filling schedules in all kinds of weather — frequently with time to spare.

### 3. Handles widely-scattered odd-jobs

The fast-moving, rubber-tired Roadster makes profitable use of any short waiting intervals . . . runs anywhere around town at speeds up to 28 m.p.h. . . . handles all sorts of scattered assignments at a moment's notice. "Pinch-hits" for hauling garbage . . . maintains alleys . . . hauls, spreads cinders, gravel surfacing . . . grades parking lots . . . removes snow. Just "say where", and operator hops on and goes. No waiting for trailer, no loading delays, no blocking! Roadster works on a production basis either as a one-man, self-loading tool or in fleet operation with a pusher.

Consider what this versatility can mean on your city landfill and maintenance programs. Get all the facts . . . write, or ask your LeTourneau-Westinghouse Distributor about high-speed, electric-control D Tournapulls TODAY!

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tire is removed its mate also is removed and both are replaced with a properly mated pair. All tires are inspected for smooth tires for recapping; cuts and bruises; alignment, wheel bearing and brake wear; valve caps and cores; air pressures; loose rims or wheels; and mismatching. By purchasing premium nylon-cord tires at 20 percent over the cost of low-bid tires they have doubled the equipment miles and obtained 50,000 recap miles at a low recap cost.

"Our Tire Maintenance Program Has Saved Us Money." By Paul J. Kaiser, Eng'r Manager, County Rd. Com. *Better Roads*, October.

### Additives in Asphalt Mixes

Some state highway departments have never permitted the use of an additive in bituminous mixes. Others have decided that those they have tried do not improve the mix sufficiently to warrant their use. Some have found that antistripping additives are decidedly beneficial in cold mixes used for maintenance patching, for surfacing work that must be done in cold, damp weather, and for seal-coat work. Some departments specify the use of additives only for early spring and late fall work. Some use it in all their seal-coat work. The opinions of ten highway officials are given in this article.

"Use of Additives in Asphalt Mixes." A Forum article. *Better Roads*, October.

### Friction Losses In Corrugated Culverts

The Army Engineers have studied the friction losses in 3 ft., 5 ft. and 7 ft. corrugated metal pipe, both with and without paved inverts. The article gives the Manning coefficient for the several pipes at various rates and depths of flow.

"Friction Losses in Corrugated Metal Pipe." *Public Works*, December.

### Stabilizing Soils By Means of Compaction

This article shows how, for cohesive soils, the strength varies with both water content and density, and with variations in rolling and lift thickness. Cohesive soils can be stabilized to yield a given strength over a fairly wide range of values. Variations in load repetitions, foot size and lift thickness produce variations in compactive effect and in optimum water content. The studies described in this paper have

been conducted under the direction of the U. S. Corps of Engineers for the U. S. Air Force.

"Stabilization of Materials by Means of Compaction." By W. J. Turnbull and Charles R. Foster, U. S. Corps of Engineers. *Better Roads*, November.

### Other Articles

"**Getting Ready for Winter**" in Genesee Co., Mich. By James T. Sharpensteen, Hwy. Eng. Public Works, December.

"Pavement Engineering Practice in **District of Columbia.**" Why and how asphalt surfaces are laid. Public Works, December.

"**Essentials in Planning** Town and County Road Improvements." By Roy E. Jorgensen, Nat'l Hwy. Users Conference. Public Works, December.

"Concrete **Pipe Jacking;**" Method employed for 1,815 ft. of 24 to 54-inch pipe for distances ranging from 160 to 300 ft. By Robert M. Innis, Resident Eng. California Highways, October.

"**Weed Control**" by spraying in Yakima County, Wash. By Hal G. Smith, Maint. Sup't, Washington State Hwy. Dept. Public Works, December.

"**Gravel** is Our Key Roadbuilding Problem in Wisconsin." Methods and equipment. By Lyle Fuller, Marathon Co. Hwy. Com'r. Roads and Streets, November.

"**Traffic and Travel** Trends, 1954." Analysis of data received from the several state highway department. By Thomas B. Dimmick, BPR. Public Roads, December.

• • •

### Flour Used to Locate Crosswalks

Sacks of flour were scattered around busy intersections in the downtown district of Cleveland, O., as part of a plan by the city traffic commissioner to better the location of crosswalks for pedestrians. Commissioner Robert J. Kelly has proposed that the pedestrian crossing lanes be better marked, especially in mid-block so that motorists will be aware when they are approaching them, giving the pedestrian a better break in getting across busy intersections.

• • •

### Dairy Farming Area Incorporates

In order to prevent annexation to a neighboring community, and to insure retention of its rural status, an area of 60 dairies, with 600 population, has incorporated. This action will prevent residential and industrial development which might force the dairies out of business.

## More work, in less time at low cost

Watch the smoothness of a modern Adams motor grader at work. See how easily it blades at any work speed. Take the wheel, drive it as you would your automobile...through city streets, to 25 mph...in reverse to 13 mph. Stand or sit at the controls, notice how clearly you see grade and load on the blade. With convenient power-controls you raise, lower, revolve or extend the blade to any desired position.

The heavy, box-construction, one-piece frame of this husky grader is built to resist shock and stresses. Weight is distributed to make use of full power in all gears. Big, powerful engine starts quickly in any temperature; has lugging ability to move heavy loads in tough going. Note how constant-mesh transmission gives smooth speed through all gears.

**8 Forward Speeds — to 25 mph**

A speed for every grading operation. You get work done fast, save time moving job-to-job. Three additional "creeper speeds" (.23 to 1.82 mph) are optional. They make it easy to rip hard-packed roads and old asphalt, root out unseen roots and stones without severe shocks, make for accurate finishing in tight places. *No other grader offers this wide range of operating speeds.*

**4 Reverse Speeds — to 13 mph**

Wide range of reverse speeds saves time on shuttle-grading and mixing, backing to buck snow drifts, etc.

**Double-action** Hydraulic Brakes. Service brake applies braking action to transmission as well as wheels; surer, safer stops, with less pedal effort.

**Rubber-Mounted Engine.** Vibration is not transmitted through floor to machine and operator. Means less maintenance, better efficiency.

**See ADAMS before you buy**

Select your next motor grader on the basis of *performance*. Ask your LeTourneau-Westinghouse Distributor for performance facts and specifications. Learn why Adams graders do *more* work, in *less* time, at *lower* cost.

Rugged scarifier (optional) rips up gravel, crushed stone, blacktop, sheet asphalt road and street surfaces. Has replaceable points.

**A Size ADAMS for every need**

**Model 330**— 80 hp diesel engine, 20,500 lbs.
**Model 440**—104 hp diesel engine, 21,500 lbs.
**Model 550**—123 hp diesel engine, 23,500 lbs.
**Model 660**—150 hp diesel engine, 27,730 lbs.
**TraveLoader** — A high-speed, heavy-duty, self-propelled, belt-type loader for picking up materials and loading into trucks from windrows or stockpiles. 55 hp, 17,500 lbs.

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PUBLIC WORKS DIGESTS

# The INDUSTRIAL WASTE Digest

### Treatment of Lithographic Wastes

Wastes from a lithographic plant in Nassau County, N. Y. contain calcium, magnesium, zinc, cupric and iron salts and hexavalent chromium. The BOD is due to albumen, gum, casein, alcohols, and organic acids. The effluent from the treatment plant is discharged into the ground and BOD removal is not a major consideration but prevention of soil clogging is. Treatment consists of daily pumping the waste into a reaction tank, where ferrous sulphate and ferric chloride are added, mixed and flocculated. The pH is maintained at 8.5 by adding lime. The clear supernatant is aerated and chlorinated; a chlorine residual of 1 ppm is maintained to provide disinfection and assure soil percolation. The sludge is dried on beds.

"Treatment of Lithographic Wastes." By John J. Baffa and Harold E. Orford. *Sewage and Industrial Wastes*, September.

### BOD of Pure Organic Compounds

A knowledge of the BOD of pure organic chemicals is of importance from the standpoint of treatment of industrial wastes. A committee of the FSIWA has compiled data from numerous sources and lists several hundred such chemicals in tables contained in this report. They are subdivided into BOD of organic acids and their salts; of alcohols; aldehydes; amines; carbohydrates; dyes; esters; and five other classifications.

"Biochemical Oxygen Demand of Pure Organic Compounds." By H. Heukelekian and M. C. Rand. *Sewage and Industrial Wastes*, September.

### Treating Celanese Waste

The British Celanese Co. in 1952 asked permission to discharge into the sewers of Derby, England a trade waste averaging 6 mgd having a BOD after settlement of about 450 ppm. To study the problem, the company built a pilot plant including upward-flow sedimentation and humus tanks and four filters, each containing 17.6 cu. yd. of clinker as a filter medium. These were operated as (1) single filtration; (2) with recirculation; and (3) alternating double filtration. A mixture of 9 parts settled sewage and 6 parts Celanese effluent was fed to the filters at the rate of 150 gal. per cu. yd. per day. Effluents were produced with BOD of 5 to 10 ppm; suspended solids 5 to 15 ppm; OA of 10-15 ppm. Alternating double filtration gave slightly better results than the other two. Experimental work is still in progress.

"Derby Sewage Disposal Works." By M. L. Francis. *Contractors Record*, Nov. 2. The Surveyor, Oct. 29.

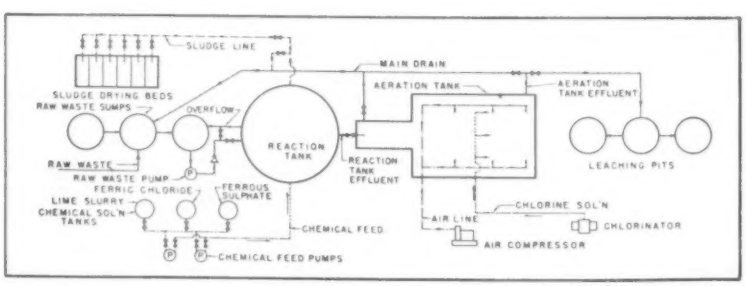
### Field Disposal of Beet Sugar Wastes

It is estimated that the beet sugar industry in the United States discharges liquid wastes having a BOD potential of nearly 3,000,000 lb. daily. The Great Western Sugar Co. has used several methods for disposing of its wastes, and is now evaluating the application of wastes to a grassland field, with several federal and Nebraska state officials cooperating. The treatment field is 160 acres of grassland. The wastes applied had a BOD value of 11,000 lb. per day. Of the 4.3 cfs with an average BOD of 483 ppm as applied, 3.5 cfs with an average BOD of 158 ppm was returned to a drainage ditch after about 14½ hr.; over 73% of the pounds of BOD applied remained on the field. Over 99% of the suspended solids was removed, and 89% of the bacteria based on MPN.

"Broad Field Disposal of Beet Sugar Wastes." By Ralph Porges and Glen J. Hopkins, Missouri Drainage Basin, USPHS. *Sewage and Industrial Wastes*, October.

### Radio-Activity In Oxidation Ponds

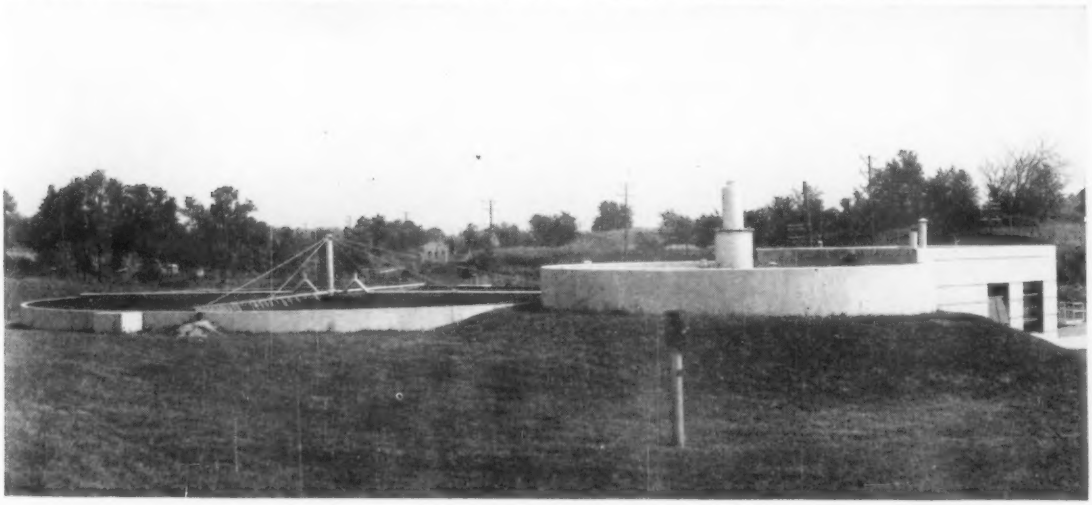
Oxidation ponds convert organic matter to algal-cell substance accompanied by an accumulation of specific substances, some of which may be radioactive. A study of this phase was made at the University of Texas and indicated that if the total detention period is long enough the algae and bacteria will die and many will become incorporated in the bottom sludge where, if half-lives of radioactive isotopes are short, much of the radioactivity will disappear. The effluent would retain some radioactivity but would lose still more by actual detention in the pond; the remainder might be eliminated by returning the effluent after removing the algae; or by removing the waste for algae concentration at the point in the oxidation pond process at which they are blooming most profusely. Proper growth conditions and operation of oxidation ponds will result in virtually complete removal of the radioactive cerium.




Courtesy Sewage and Ind. Wastes

● **PLANT layout to treat wastes from lithographic plant.**

*Left, PFT Rotary Distributor for 85' filter bed; right, 35' digester with PFT Floating Cover. Foreground, PFT Waste Gas Burner*



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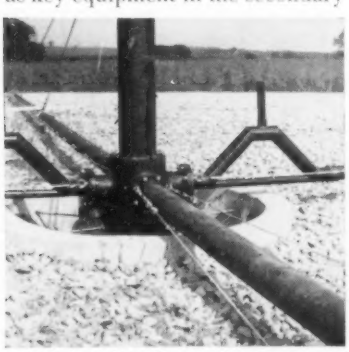
A *PFT Rotary Distributor* serves as key equipment in the secondary treatment process by providing uniform distribution of settled sewage over the entire trickling filter bed.



*PFT Rotary Distributor showing rugged construction of center column and Low-Loss Overflows on secondary arms.*

Equipped with PFT Low-Loss Overflows, the distributor automatically operates as a 2 arm or 4 arm unit to accommodate the wide range of flows normally found in smaller plants. PFT's exclusive spreader jet design assures uniform distribution at all flows and effectively eliminates clogging.

For accelerated digestion and trouble-free service, a complete "Controlled Digestion" system was installed consisting of the following items from PFT:

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*Design of plant by* / *Warren & Van Praag, Consulting Engineers, Decatur, Illinois*

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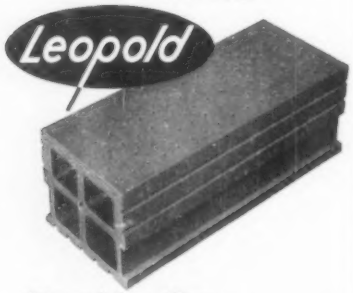


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"Concentration of Radioactivity in Oxidation Ponds." By E. W. Steel, Prof., and Earnest F. Gloyna, Assoc. Prof. of San. Eng., University of Texas. *Sewage and Industrial Wastes*, August.

### Effects of Sulfur On Sludge Digestion

From a study of the effects of several sulfur-containing compounds on sewage sludge digestion, supported by a grant from the USPHS, the authors drew the following conclusions: In a digester, sulfite is reduced to thiosulfate, and then to sulfide. The presence of even 50 ppm sulfite sulfur retarded digestion and 100 ppm almost completely inhibited it. Sulfide further retards it. The effect of any sulfide on sludge digestion depends upon (a) the concentration of the sulfide salt; (b) the solubility of the salt; (c) the concentration of sulfide in the salt; and (d) the acidity of the salt. The sulfide has a direct inhibitory effect upon the organisms responsible for gasification; and by reducing gasification, volatile acids which lower the pH have a greater inhibitory effect upon gasification.

"Transformation and Effects of Reduced Sulfur Compounds in Sludge Digestion." By Donald B. Aulenbach and H. Heukelekian, Rutgers University. *Sewage and Industrial Wastes*, October.

### Other Articles

**"Ceramic Waste Treatment,"** to prevent discharge of fine clays into the Patapsco river, Maryland. By G. M. Boyd and K. S. Watson, Gen. Electric Co. Sewage and Industrial Wastes, September.

"Suggested Procedure for Evaluation of **Biological Oxidation** of Organic Chemicals." By E. J. Mills, Jr., and Vernon T. Stack, Jr., Carbide and Carbon Chemical Co. Sewage and Industrial Wastes, September.

**"Ground Water Pollution** from Industrial Wastes" on Long Island, N. Y. By W. Fred Welsch, Nassau County Dept. of Public Works. Sewage and Industrial Wastes, September.

"Anaerobic Digestion of **Pea-Blancher Waste.**" Review of literature and laboratory investigations. By Gordon E. Olivier and Gilbert H. Dunstan, State College of Washington. Sewage and Industrial Wastes, October.

"Waste Water Use in a **Soap and Edible Oil Plant**" effected successfully by flotation separation. By R. E. Sessler, Eng., Lever Bros. Co. Sewage and Industrial Wastes, October.

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## Research in Sewage and Industrial Waste Treatment

The recently published "Review of Current Research" reports on approximately 7,500 research projects. A review of the book will be given elsewhere (see note at end of this article), but some of the projects involving sewerage, sewage treatment and industrial wastes are enumerated here to give a better idea of the scope of the subjects covered.

**Algae:** Algae symbiosis is being studied at the University of California: the oxidative metabolism of euglena at the University of Illinois; an algae machine at the University of Oklahoma; the use of algae in the treatment of radioactive wastes at the University of Texas; and effect of algae on content of streams and algae growths in sewage plant effluents at University of Wisconsin.

**Industrial Wastes:** A wide range of industrial wastes are being studied. Decolorization and adjustment of beet wastes by Oregon State College; brewery wastes treatment by Purdue, which is also studying strawboard, dairy, petroleum and vegetable wastes (using lime), cyanide and other toxic wastes and wastes disposal from food canning plants; Washington State is working on cannery waste disposal by irrigation. At Florida, research includes purification of citrus wastes. Electroplating wastes, including oxidation of cyanide and cyanate ion are being studied at Yale. Pennsylvania State is working on the use of biological oxidation in dairy waste treatment, on dairy waste stream pollution on spray irrigation, and an evaluation of poultry dressing wastes. Oregon State is running a project on the effect of biological treatment of Kraft wastes on toxicity to fish. Treatment of packing plant wastes are being studied at Wisconsin. Stream self-purification factors in the disposal of liquid low-level radioactive wastes are being investigated at Harvard; decontamination of radioactive wastes at MIT; and disposal of such wastes into the ground at Notre Dame. At Rhode Island, a study of design, operation and efficiency of existing textile waste treatment plants, and a study of methods of treatment for cotton finishing wastes are under way.

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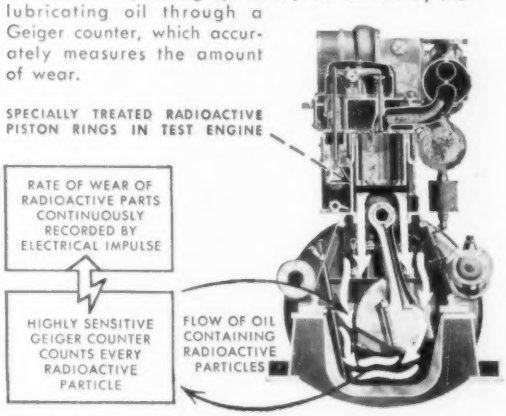
SPECIALLY TREATED RADIOACTIVE PISTON RINGS IN TEST ENGINE
RATE OF WEAR OF RADIOACTIVE PARTS CONTINUOUSLY RECORDED BY ELECTRICAL IMPULSE
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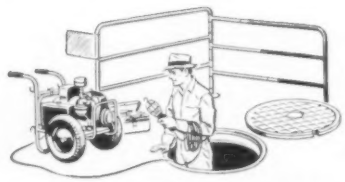

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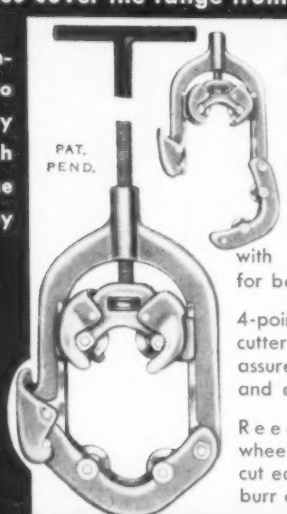


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**Sewage and Sewerage:** California Institute of Technology is studying the application of membrane filters to the bacterial assay of sewage, fundamental factors in the sedimentation of sewage, and sterilization of settled sewage. Arizona will shortly start a study of the efficiency of sewage ponding practices in the southwest. Florida is investigating the microscopic biota of sewage, also industrial wastes and natural pollution. Preaeration in sewage treatment is under research at Iowa State. Michigan State is studying purification of sewage on natural and artificial forest loam. N.Y.U. has projects on sewage filtration and on the effect of detergents on sewage treatment. An unusual study is that of sewerage and drainage in St. Louis, Mo., 1764-1954, at St. Louis University. Texas A & M has four studies under way—purification by rock filters, durability by metal pipes exposed to sewage gases, sedimentation of sewage and comparison of criteria for sewage strength. University of Texas also has a number of projects: The action of biocatalysts on sludge digestion, use of algae in the treatment of radioactive wastes, treatment of wastes by oxidation ponds, effect of sea water on the BOD removal by a trickling filter and effect of irrigation with sewage on soils.

Drying of sewage sludge is under study at the University of Washington. Wisconsin has a number of projects, including in addition to those listed elsewhere in this article, effect of air flotation in removing solids from domestic sewage and industrial waste, removal of nitrates from sewage effluents by ion exchange resins, sewage filtration with rotating tubes and two algae projects already listed. To start very soon are studies on the effect of preaeration on performance of primary clarifiers and effect of shape on performance of digestion tanks.

Research in activated sludge is being carried on at Illinois; at North Carolina on mechanisms of absorption by activated sludge; and a program is scheduled to start soon at Wisconsin. Michigan State is studying sludge dewatering; Oklahoma has a pilot digestion plant; and Wisconsin has the digester study listed above.

Though by no means complete, the listings above show the wide range of work now under way. A review of this text will be found on page 56 of this issue with information on how to order copies for reference.

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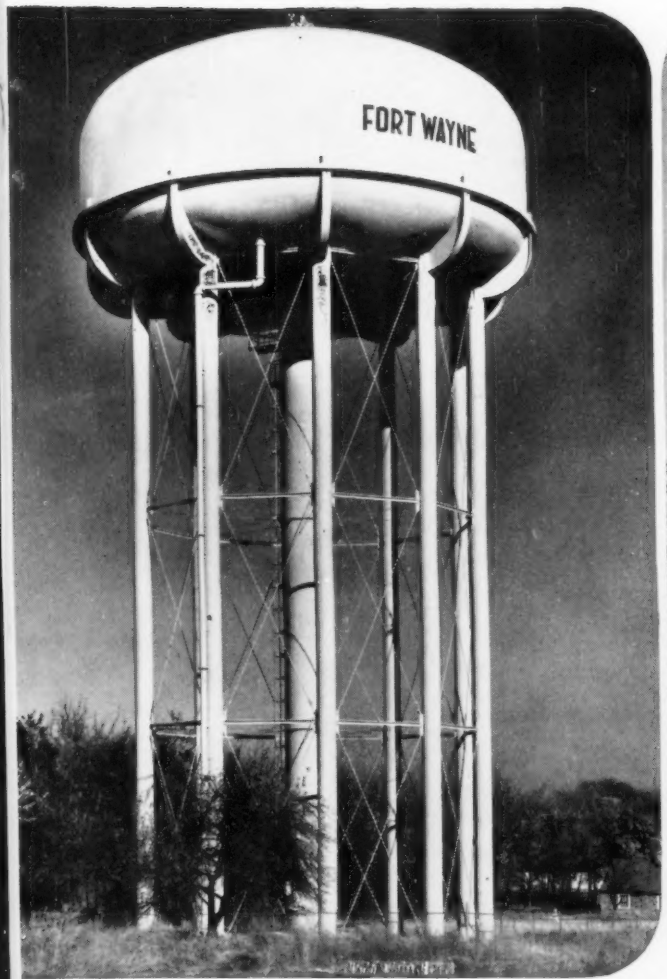


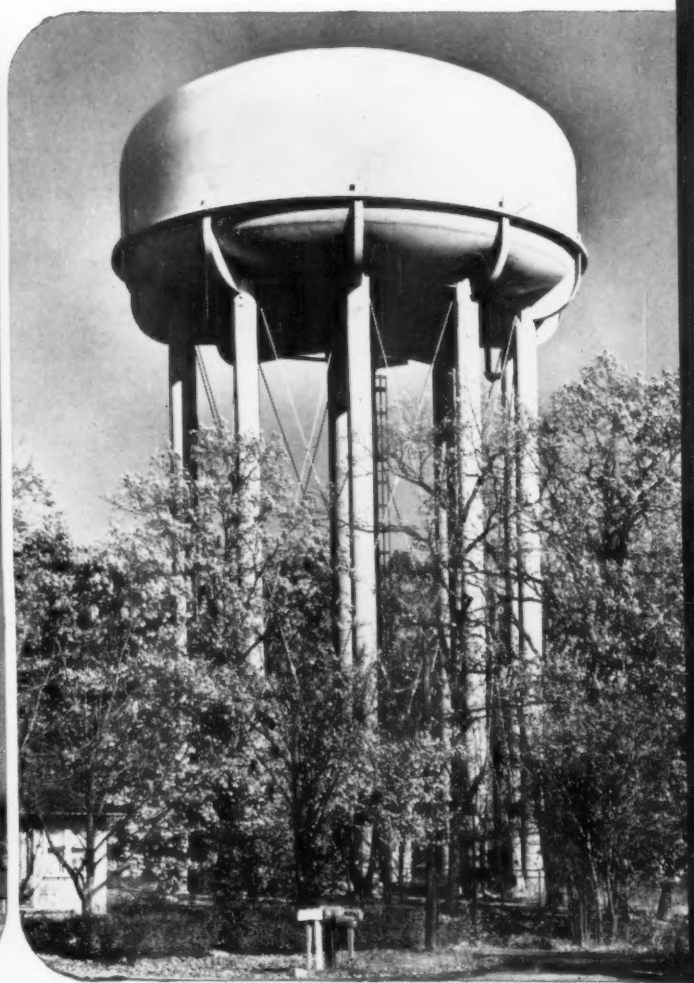

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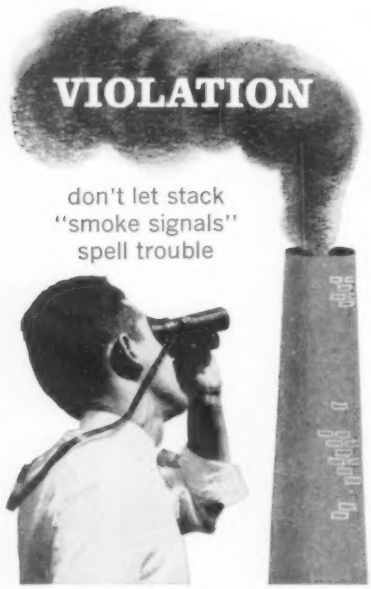


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# RELIEF MAP

## Produced by Aerial Photography

A TOPOGRAPHIC relief map, 6 x 7½ ft., of the Seattle area will help officials of that city with their planning problems. The new map is a lightweight plastic model produced recently by Aero Service Corporation, Philadelphia. The map scale is 1 inch=½ mile and covers 1656 square miles. Elevations below 1,000 feet have a vertical exaggeration of 3:1, and elevations above that height have been given a vertical exaggeration of 2:1. This is necessary to emphasize land forms and drainage patterns; vertically the map is accurate to 1/32nd of an inch. Highest point is a peak in the Cascade Mountains, five inches above the lowest point on the relief map.

The corporate body of the city of Seattle embraces some 88 square miles of land and 3 square miles of water surface. Its water supply and waste channels reach into the mountains and tides beyond the city limits. Therefore, when a new water supply line or power line is brought into the city, the problem is a complex and difficult one. Successful planning calls for a good visual presentation of the geographic areas and physical problems involved. The new relief map will help greatly to solve such problems. It covers an area from Puget Sound to the crest of the Cascade Mountains, east to the King County line and south to Starr Lake. With this new relief model at hand, an engineer can demonstrate water flow problems by pouring water on a mountain divide and watching it flow down creek and river into Puget Sound.

As a further aid to engineers, the new map carries all section corners. They were carefully surveyed in scale with a miniature transit after the map was completed. The map information is shown in 4 colors—black for city streets and place names, blue for rivers and lakes, green for parks, and red for township boundaries. The surface of the map has been plastic coated to protect these inks; dust, dirt and fingerprints will wipe off readily with a damp cloth. Weight of the map is only 65 pounds, including a rigid plywood mounting.

● **COURSE** of the Snoqualmie River and its drainage area is pointed out on the model. Scale is 1 in. = ½ mi.

● **SEATTLE** officials will use this big relief model for planning water supply lines and many other projects. Lightweight model was produced by aerial mapping.

# ANNEXATION COSTS AND CHARGES

**JOSEPH F. BASE,**

**City Manager, Santa Clara, California**

***This article is based on a report by Mr. Base to the Mayor and Council of Santa Clara, California. It is slightly condensed from the original report.***

IN ANY SCHEDULE of charges to be made in connection with future annexations, consideration must first be given as to (1) the charges made to cover the cost of immediate and future capital improvements and (2) the expenses incurred by the City in processing an application for annexation from its inception to final completion. These two categories should normally cover all the costs incurred by the City in taking in new properties.

### *Capital Improvements Cost*

Assuming that the area to be annexed is entirely unimproved, the capital improvement costs required to bring the area up to a standard comparable to the rest of the City would involve:

(a) Sewer Improvements: (1) Sanitary sewerage system; (2) sanitary sewage treatment; (3) storm drainage system; and (4) storm drainage outlet facilities.

(b) Street Improvements: (1) Pavements; (2) curbs and gutters; (3) sidewalks; (4) street lights; and (5) street name signs.

(c) Water System Extensions: (1) Distribution lines and services; 2) main transmission lines; and (3) water supply facilities.

(d) Electric System Extensions: (1) Distribution lines and services; (2) main transmission lines; and (3) substation and transformer facilities.

(e) Recreation Area Lot Fund: (1) Contribution for lot acquisition and capital outlays.

Normally the manner of defraying the cost of municipal improvements and facilities is by special assessment, general obligation bonds, and revenue bonds. In order to illustrate more clearly the policy and practice now followed in the City of Santa Clara, the cost of the various listed items will be summarized on the basis of "per lot", rather than "per acre."

Our present policy provides that the subdivider pay the entire cost of the on-site sanitary sewer system, including all laterals and house connections. This work is done by contract let by the developer and the City makes an inspection charge of 2½% of the cost of the work. The City extends its trunk sanitary sewer facilities to connect with the subdivision sewerage system and conveys the sewage to the San Jose outfall sewer and treatment plant. These is no service charge or "sewer rental" for this service. Before an area is annexed the developer is obliged to consent to the taxation of the subdivision property for the City's outstanding bonded indebtedness which includes the bonds for the trunk sewer system and plant.

A similar policy and procedure is followed for the on-site storm drainage facilities, the cost being entirely paid by the subdivider. The City provides for off-site storm drainage outlet facilities, these usually consisting of short lines terminating in our existing creek channels. Some consideration has been given from time to time regarding requiring a contribution from the developer toward the cost of these

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off-site storm drainage facilities. Up to the present, this cost has not been too serious, but as the City develops into the lower contour areas this problem will naturally increase. It was for this reason I recently recommended that a uniform policy be adopted calling for a contribution of $50 per lot toward the cost of off-site drainage.

### Street Improvements

The subdivider is obliged to pay the total cost of the street pavements within the tract, subject to a 2½% inspection fee by the City Engineering Department. In exceptional cases where the designed width of the pavement is greater than necessary to serve the subdivision area, as for example on a major city street, the City makes arrangements with the developer to pay the difference, generally from Gas Tax funds. Concrete curbs and gutters are also installed at the expense of the subdivider, subject also to 2½% inspection fee by the City. Similarly, concrete sidewalks are also installed at the cost of the developer, subject to City inspection and City standards.

Our agreement with subdividers also provides that the cost of aluminum alloy street lighting standands, together with bracket arms and fixtures are to be borne by the subdivider's expense, including all partment providing the necessary labor for installation.

Uniform street name signs are also required to be installed at the subdivider's expense, including all materials and necessary labor.

### Water and Electricity

Prior to November, 1952, the subdivider paid for the on-site cost of water mains and services, the City reimbursing the developer for the cost of labor and material involved by monthly refunds of a portion of the revenue over a number of years. Since then the policy was changed and we are now requiring the developer to pay for the cost of all materials including mains, valves, fittings, hydrants and individual service connections, the City merely furnishing the labor for installation and there are no refunds whatsoever.

In cases where a main larger than necessary to serve the local area is installed in order to serve territory beyond the subdivision, the City bears the difference in cost from the Utility Fund.

Main transmission lines either as extensions from existing lines, or from the pumping plant location, are installed at the expense of the Water Department with the intent of recovering the cost of such installation from abutting property as soon as the areas between the pumping station and the subdivision are developed. As additional sources of supply are required to meet increasing demands or to serve new areas, wells are drilled and pumping facilities installed as a general cost of the Water Department.

A similar policy to that followed in water system extensions is also applied to our electric plant facilities. The materials necessary for on-site distribution lines and new house services are furnished at the expense of the subdivider, the Electric Department furnishing the necessary labor. This practice also applies to street lighting installation mentioned under street improvements above.

### Recreation Area Lot Fund

It has for some time been the policy and practice to require subdividers to contribute an amount per lot which is accumulated in the recreation area lot fund and used for the acquisition of park and play-


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Last year more than a thousand American communities suffered the dire calamity of a water shortage, due in many instances to inadequate distribution facilities. Many more this year are facing the same grim crisis. In fact, it has been estimated by government officials that America must spend $25 billion in the next ten years to catch up on water and sewer needs.

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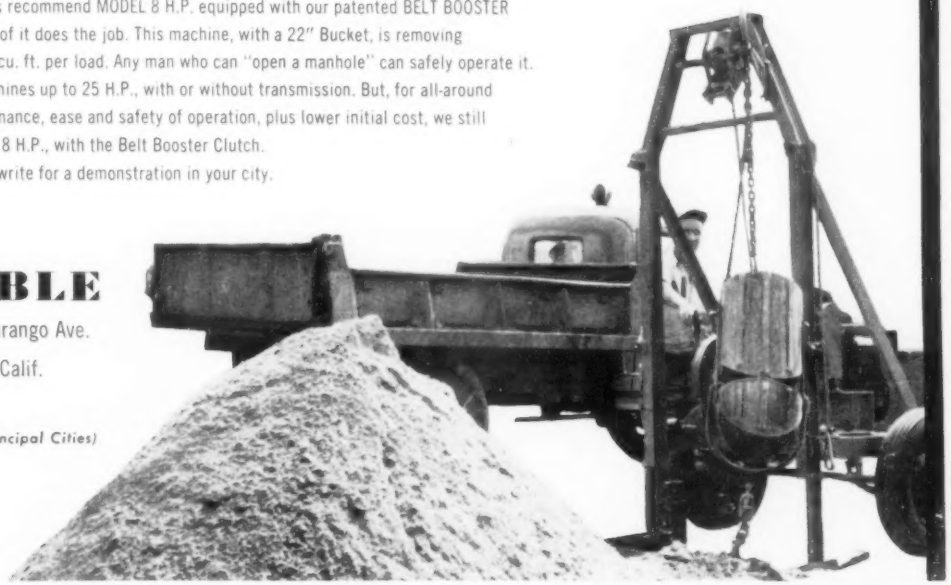


ground sites and the payment of permanent improvements, equipment, etc., on such sites. Originally this amount was $20 per lot but has recently been increased to $25 per lot. The approximate average cost per lot to the subdivider under the above-described arrangements are Sewer improvements $250; street improvements $525; water extensions $110; electric extensions $120; and recreation area lot fund $25. This totals per lot $1,030.

### *Annexation Expenses*

The costs for expenses incurred by the City from the time the Application for Annexation is initiated until the Certificate of Annexation is received from the Secretary of State have all been borne by the City in the past, no charge whatsoever being made for the annexation application or for any intervening steps in the annexation procedure. An analysis of annexation costs was made for 27 uninhabited territory annexations and 3 inhabited territory annexations (requiring elections).

*Uninhabited Territory Annexations*—The costs which have been compiled include annexation engineer's billings, legal publication costs and other incidental expenses. They do not include any administrative or overhead charges. The average cost per uninhabited territory annexation was $222. On an area basis the average uninhabited territory annexation cost was $5.34 per acre. However, the habited territory annexation cost per acre showed wide variations.

*Inhabited Territory Annexations*—This category also includes annexation engineer's billings, legal publication costs, election expenses and other incidental charges. The average cost per inhabited territory annexation (those requiring elections) was $547.

• •

## Anti-Litter Campaign

(*Continued from page* 99)

Education section is concerned primarily with the City schools, civic, fraternal and religious and business groups throughout the city. Approximately 1,000 school meetings attended by 300,000 children are presided over by the members of the Sanitary Education staff each year. Short talks, supplemented by Department documentary film, and a question and answer session make up the standard operating procedure of each meeting.

The major steps in New York City's anti-litter campaign are universal in design and could be adopted by all communities with necessary modification in magnitude, scope and personnel. As outlined below, the City's program may well serve as the basis of similar drives in those communities plagued with litter problems. Essentially the problem was handled by

1—The establishment of a community of interest between the Department, the City administration and other City departments and public agencies by the establishment of the Mayor's Interdepartmental Committee for a Clean City;

2—The formation of the Citizens' Committee for a Clean City which had the power, drive and desire to accomplish its aim;

3—The development of a Public Relations program to bring the Department and the population into close rapport;

4—The enactment of corrective legislation and the establishment of an adequate and effective enforcement agency;

5—The planning, investigation and survey of the causes and sources of litter and the development of the necessary remedies;

6—The establishment of the household junk collection service

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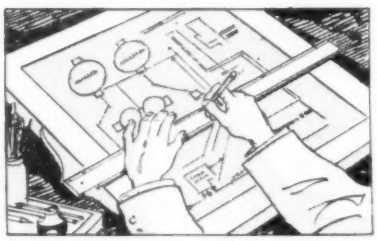

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and the special Sanitation service bureaus;

7—The distribution of litter baskets on a wide scale throughout the city; and

8—The posting of warning signs on light poles throughout the city.

Although these efforts have contributed in a large measure to the noticeable improvement in the appearance of the streets of New York, the campaign will go forward unabated until the goal of a clean city is reached.

• • •

### Toledo Revenue from Parking Meters

Parking meter revenues in Toledo, Ohio, through August 31, 1955, were $140,654.65 as compared to $99,400.99 for the same 1954 period. The daily average per meter rose to $0.527 in 1955 from $0.38 last year.

• • •

### Poison Ivy and Oak

(*Continued from page 95*)

subsequent patch testing with the plant antigen or active ingredient. This procedure is contraindicated in a hypersensitive patient and is seldom necessary to establish the diagnosis.

Treatment varies both as to method and to the degree of success. The most successful prophylactic treatment is actually avoiding contact with the noxious plants, either by not entering the area where the plants grow or by the destruction of the plants. The latter, however, is feasible only in small areas.

When entering areas where exposure is probable it is advisable to wear long clothing so as to cover as much of the skin as possible. Protective creams may be used on the remaining exposed areas; however, these creams frequently are not acceptable either because they are removed by activity, body heat or perspiration. In general prophylactic desensitization with plant extracts is not advisable except for a few selected cases.

After known exposure, the skin should be washed with soap and water. Laundry soap is preferable to bath soap because its high alkali content helps to remove the oleoresin. The skin should then be cleansed with alcohol to remove any excess oleoresin. In evaluating soap and water, ferric chloride solution, potassium permanganate solution, and sodium perborate ointment, the following conclusions were reached: Soap and water were effective if used

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within 1 minute after exposure: a 10 per cent solution of potassium permanganate was effective if used within 5 to 10 minutes; ferric chloride solution and sodium perborate ointment were of no value.

The use of these materials, however, may result in varying degrees of success. Clothing and other carriers such as tools can be decontaminated by soaking for 15 minutes in a 1 per cent solution of calcium hypochlorite. Clothing should be laundered after soaking.

Treatment of the dermatitis resolves itself into local and systemic methods. Locally, the skin should first be cleaned with soap and water and alcohol. Small blisters should be broken with an alcohol sponge, large blisters may require opening with a scalpel or scissors. Wet compresses soaked in Burow's solution —1:20 to 1:100 dilution—should then be applied to the affected area for 20 minutes every 4 hours until the symptoms subside. Following the compresses, a drying solution, such as calamine lotion, should be applied. Various antihistaminic lotions and creams, and hydrocortone ointment have been advocated. The former have not proved successful, and the latter is indicated only when allergic manifestations such as hives and edema develop.

Systemic treatment, using oral or parenteral antihistamines, has been advocated in the past to alleviate both local and general symptons. Most authorities agree that therapeutic inoculation of plant extracts is not advisable for the active treatment of the dermatitis. ACTH solution, or depot gel by injection, or cortisone orally is indicated for those cases which are severe and in which there is serious allergic manifestation. The dose of both of these steroids should be small and they should not be continued over a long period of time. Of course, these drugs should not be given if there are any contraindications to them.

To prevent complications from secondary infections and other sensitization reactions which may result from the injudicious use of medications, lay persons should be cautioned to attempt treatment in mild cases only. Moderate or severe cases, and epecially those with allergic manifestations, should be referred to a competent dermatologist for treatment.

This Article somewhat condensed appeared as an abstract in the Medical News Letter published by the Navy Dept. and is from the Am. J. Nursing, July 1954 by W. N. Piper, M.D.

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**Published Monthly** **January, 1956**

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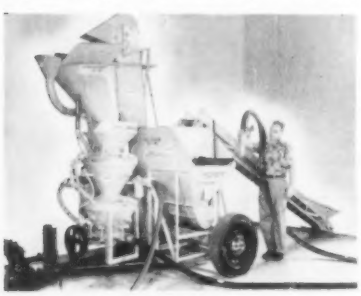
A new back-hoe that digs at right angles to either side of the tractor as well as to the rear is now available from Mid-Western Industries. The right angle feature makes it ideal for cleaning and digging of roadside ditches, irrigation and drainage canals, or for digging around the corner of a building and in crowded areas where trees, boulders or buildings won't permit a standard back-hoe to operate. It also allows all the spoil to be dumped to just one side of the hole with plenty of room in between the spoil pile and the hole so that the dirt won't fall back in. The back-hoe is available in combination with the Davis loader and is mounted directly onto the loader frame. It uses the same pump as the Davis loader and is hooked up to the hydraulic system with quick-couplers for fast removal. A selector valve lets the operator have immediate control of either the loader or the back-hoe. Individually controlled hydraulic stabilizer feet are on each side of the exceptionally wide frame so that the unit can be leveled up on slopes for digging plumb holes and so that it is virtually impossible to turn the unit over. For further information write Mid-Western Industries, Inc., Wichita, Kans., or circle **No. 1-1** on the coupon.

**Right-angle** digging feature of Davis back-hoe helps speed ditch cleaning

## Portable Concrete Gunning Rig Handles All Jobs

A completely new portable concrete gunning rig, adapted for all types of such work, is announced by Air Placement. The rig is made up of 3 basic pieces of equipment: the Nucretor concrete gun; the Mix Elvator automatic proportioning, dry mixing and elevating machine; and the sand loader. It is designed so that the entire unit may be hitched to either the air compressor or to the trailer hitch of a truck. Additional information from Air Placement Equipment Company, 1009 W. 24th St., Kansas City, Mo., or circle **No. 1-2** on the coupon.



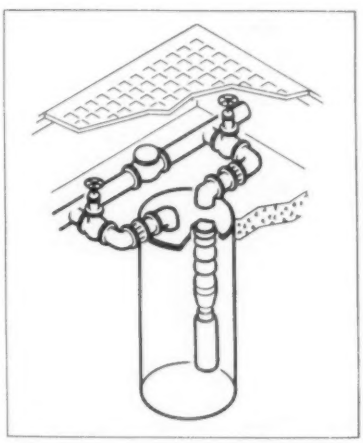
New **sand loader** is a labor saving addition to Nucretor gun and Mixelvator

### Optional Air Lift Available with Graver Reactivator

An optional air lift to replace the mechanical recirculator in its solids-contact clarifier, the Reactivator, is announced by Graver. The Reactivator has a wide range of application in industrial, municipal and waste treatment fields. For certain types of treatment processes, the mechanical impeller may be replaced by an air lift arrangement to provide recirculation. The resulting aeration is most useful in installations requiring iron removal. Air is brought in to the central uptake tube of the Reactivator where it is released and the upward flow of the air bubbles carry recirculating precipitates up the tube, mixing them with incoming raw water in much the same manner as the mechanical impeller. Further information from R. S. Lewis, Graver Water Conditioning Company, 216 West 14th Street, New York 11, N. Y. or circle **No. 1-3** on the coupon.

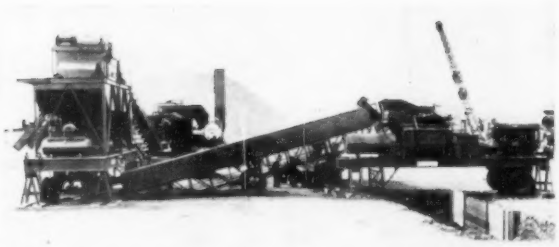
### New Submersible Booster Pump For Municipal Use

The Verti-line submersible booster pump offered by Layne & Bowler is especially designed to meet the rigid requirements of municipal pump users. The pump provides invisible and noiseless operation, extra dependability in any weather and minimum space requirements. Standard models available from 5 to 150 hp., with discharge head 50 to 500 feet and 100 to 4,000 gpm. capacity. They are suited to typical sump, line booster, cooling tower, fire protection and barrel pumping installations. For full details write Layne & Bowler Pump Co., 2943 Vail Ave., Los Angeles 22, Calif., or circle **No. 1-4.**



Layne & Bowler **pressure booster** unit is located in a manhole under street

**Aluminum** truss type sign span illustrated here is 48 feet wide. Unit has been tested under loads of 60 lbs. per ft.



H & B **asphalt plant** has been designed for ease of erection, complete portability and flexible set-up arrangement

## Aluminum Sign Span Needs No Maintenance

A new sign span is available from Pfaff & Kendall in which a new type of aluminum fabrication is being used. Supporting shafts are seamless, tapered all aluminum, with the span all welded of individual sections. The span is light in weight, easy to install and does not need painting. For full data write Pfaff & Kendall, 84 Foundry Street, Newark, N. J., or circle **No. 1-5.**

### Quick-Way Truck Shovel Announces Four New Models

For 1956, four new Quick-Way shovels and five new Quick-Way carriers have been announced. The new shovel models include a 5-ton ¼-yard; an 8-ton ⅜-yd.; a 10-ton ½-yd.; and a 12½-ton heavy duty ½-yard. There are also five new carriers, built to heavy duty specifications and specific capacities for the new shovel units. All of the shovels are fully convertible with Quick-Way's many attachments. Engineering features of the new units include: (1) power up-and-down boom; (2) anti-friction bearings on all high speed rotating shafts; (3) heat-hardened rollers on all chain drives and sprockets; (4) air-cooled clutch and brake drums; (5) smooth hydraulic system and controls; (6) advanced lubrication provisions; (7) hinged foldout panels for easier adjustment and maintenance; and (8) a comfortable and well-ventilated cab. Full data from Quick-Way Truck Shovel Co., Denver, Colo., or circle **No. 1-6.**

### New FWD Highway Maintenance Truck and Sander

The FWD new general highway maintenance truck, Model M-264, is able to do many jobs. It is equipped with dump body and an underbody blade and the four-wheel-drive truck can be utilized for ice control, snow plowing and hauling in the winter months in the snow belts. In warm weather, it can be equipped for road grading. Any special body can be used in general highway maintenance or for heavy-duty hauling. The dump body sander uses the injector method of feeding the material spinner; the width of spreading is controllable from 40 feet down and the speed of feed is variable. The unit also has automatic deflectors so the sand or other material can be shut off to one side in traffic. For more information write Four Wheel Drive Auto Co., Clintonville, Wis., or circle **No. 1-7** on the coupon.

FWD **maintenance** truck has underbody blade and equipment for snow control

## Portable Batch Plant Delivers 100 to 120 Tons of Mix per Hour

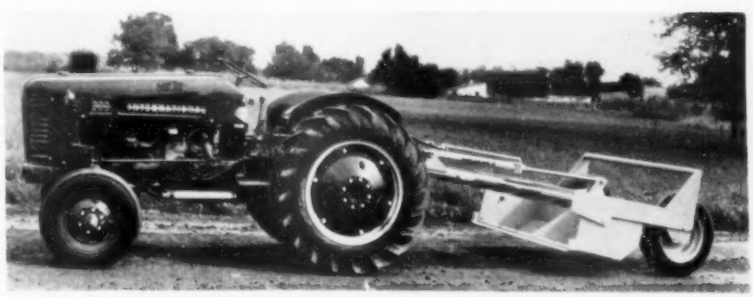
A new and completely portable batch type asphalt plant with a capacity range of 100 to 120 tons per hour is announced by Hetherington & Berner. All units are wheel mounted and no crane is needed for erection; the piping and wiring are permanently installed. All remotely located units are driven with electric motors. Complete information and specifications from Hetherington & Berner, Inc., 701 Kentucky Avenue, Indianapolis 7, Ind., or circle **No. 1-8** on the coupon.

### Automatic Clutch for Ice-Control Spreader

An automatic clutch keeps icing, jamming and high-chock motor loads from interfering with the operation of an ice-control spreader. For full details write Mercury Clutch Division of Automatic Steel Products, Inc., Canton, O., or circle **No. 1-9** on the coupon.

## New Shawnee Scraper for Light Maintenance Work

A new 2-wheel hydraulic scraper, announced by Shawnee, is for mounting on the International "300" Utility Tractor. The scraper has a capacity of ⅝ yd. and the 66-inch wide cutting blade extends beyond the wheels and sides of the scraper permitting unlimited digging depth. This scraper is especially designed for digging small excavations, leveling, small roadway jobs, cutting drainage ditches and general clean-up work. Additional information from Shawnee Manufacturing Company, 1947 N. Topeka Avenue, Topeka, Kansas or circle **No. 1-10.**



**Hydraulically controlled** scraper operates from driver's seat; has ⅝-yd. capacity

# Galion Announces the T-700 Heavy-Weight Grader

**Power, weight and blade pressure** of this grader are matched to move more material

A new motor grader available from Galion, the T-700, designed and built new from the ground up, has a total weight, with scarifier, of 40,125 lbs. It is powered by a 190-hp diesel engine. Equipment includes the Grade-O-Matic drive which utilizes a torque converter and power-shift transmission. There are 3 speeds forward and 3 reverse, with speeds ranging from creeper to high travel speeds in either direction. Other features include a hydraulic shiftable moldboard 14 feet long, and four-wheel hydraulic service brakes, plus a transmission brake for parking. For complete information write The Galion Iron Works & Mfg. Co., Galion, Ohio, or circle **No. 1-11** on the coupon.

### New Line of Superior Sidebooms

This complete line of sidebooms consists of six models, from the PBI-9A to the PBI-241BH, which are designed for International Harvester tractors TD-24 to TD-9. New features are the bottom hinged, hydraulic extendable counter-weights operated and powered by a combination pump and valve tank unit. The upper limit lifting capacity is 110,000 lbs. Also new is a change of the operating levers from vertical to horizontal position for better control. For full details write Superior Equipment Co., Bucyrus, Ohio, or circle **No. 1-12** on the coupon.

### Aerial Towers for Mounting on Motor Trucks

Three highly-maneuverable, hydraulic, operator-controlled aerial towers, designed for mounting on conventional motor trucks are available from Strato-Tower. Maximum platform heights are 30, 44 and 60 feet, and each model is available with wheeled outriggers or with spring lock-out table. The platform at the end of the double-jointed boom is self-levelling and gives 24″ x 48″ working area. With the boom resting over the truck cab, the unit can be moved through traffic at regular speeds. Complete information from Strato-Tower Division, Elkhart Welding and Boiler Works, Inc., 2132 S. Main Street, Elkhart, Ind., or circle **No. 1-13.**

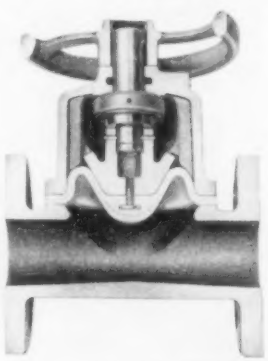
### Bituminous Plant Redesigned for Greater Adaptability

A redesigned continuous mix bituminous plant featuring adaptability to varied types of jobs has been announced by Pioneer. Production capacity of the Model 102 plant ranges up to 200 tons per hour, depending on material conditions. It has two main units—a combination drier and dust collector and a combination gradation-mixer. Each is compactly assembled in a straight line on a single chassis. Detailed specifications can be obtained from Pioneer Engineering Works, Inc., 1515 Central Avenue, Minneapolis 13, Minnesota, or circle **No. 1-14** on the coupon.

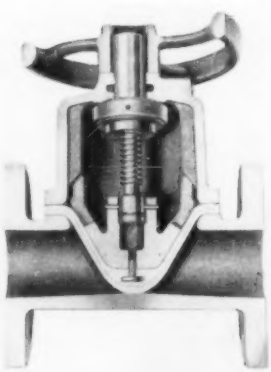
### A Useful Attachment for Motor Graders

The Galion hydra-tilt moldboard attachment is especially suited for more effective road maintenance, ditching, sloping, finishing, mix-in-place jobs and ice and snow removal. It works equally well with regular or hydraulically shiftable moldboards. Two hydraulic cylinders are supplied, one for attachment on each side of the circle. For complete information, write The Galion Iron Works & Mfg. Co., Galion, Ohio, or circle **No. 1-15.**

# Diaphragm Valve Features Straight-Through Flow



**Open-no flow obstructions**



**Closed—diaphragm is tight**

The Grinnell-Saunders Straightway diaphragm valve features the advantages of straight-through flow for handling viscous materials, fibrous slurries, sludges, semi-fluids and solids in suspension. The valve is claimed to handle such materials without restriction or stoppage, with minimum pressure without damage to body linings, and self-drainage when the pipe line is pitched sufficiently to drain the piping. The Straightway valve gives positive closure when handling gritty or fibrous material; isolation of bonnet from fluid stream; wide range of body and bonnet styles, as well as body, lining and diaphragm materials. For full details write Grinnell Co., Inc., Saunders Valve Dept., 260 West Exchange St., Providence 1, R. I., or circle **No. 1-16** on the coupon.

# Truck-Mounted Ladder Facilitates High Servicing

A new truck-mounted ladder that incorporates both mechanical and hydraulic principles is now available from Holan. A low-pressure hydraulic system combines with center mast counterbalancing to provide rapid, easy lowering and raising of the ladder. Elevating locations are infinite, and the angle of elevation can be changed with the ladder fully extended. The new ladder rotates 360 degrees and elevates to 72 degrees and is available in 24, 28 and 32-foot ground-to-platform heights with standard or duo-level platforms. Rotation can be worm and gear or pin type and telescoping bar. For more information write J. H. Holan Corporation, 4100 W. 150th Street, Cleveland, Ohio, or circle **No. 1-17** on the coupon.

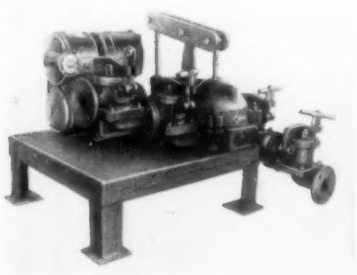
**Holan ladder** has two-speed hand pump; is easy to raise

### Crack Cleaner for Pavements

This welded tube frame crack cleaner is capable of cleaning cracks in either bituminous concrete or cement concrete pavements to a depth of ½-inch and a width of ½-inch. The cleaner is powered by a 1 1/3-hp gasoline motor and weighs 40 lbs. It can also be used on sidewalk, tennis court, driveway and airport maintenance and repair. For full information write DonAir Assocs., 15812 Arcade Avenue, Cleveland 10, Ohio or circle **No 1-18** on the coupon.

### New 2" Diaphragm Slurry Pump

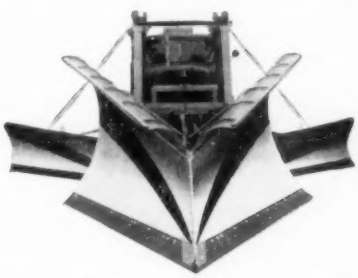
A new 2-inch diaphragm slurry pump, anncunced by Komline-Sanderson, is a self-contained unit featuring dual-ball check valve design and variable speed drive. These features permit gentle pumping action, positive feed and metering characteristics and minimized clogging. The pump is available in capacities ½ to 5 gpm, 1 to 10 gpm and 2 to 18 gpm. For full details write Komline-Sanderson Engineering Corp., Peapack, N. J., or circle **No. 1-19** on the coupon.



**Komline-Sanderson** 2-inch slurry pump

# 3-Way Snow Plow

The new "Wausau" triple 3-way snow plow is three plows in one designed for airports, turnpikes, thruways and all modern highways. It can be positioned as a "V" Plow, as a one way right hand discharge or as a one way left hand discharge. It combines the plowing features of the one way, reversible and Vee plow, to meet the need for a high speed snow plow that can discharge snow to right or left as required by wind conditions existing on airports, boulevards and turnpikes. It is operated by hydraulic power from within the cab and the "V" can be shifted while in motion, to right or left at 35 degrees. For additional information write Wausau Iron Works, Wausau, Wisc., or circle **No. 1-20** on the coupon.



**Cutting width** with V alone in 11' 6"; with V and two wings width is 23' 6"

### Wood's Rotary Mower-Shredder

This rotary mower-shredder, Model 42M, is furnished by Wood for mounting underneath the Massey-Harris Pony and Pacer tractors.

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sliding or screw type cast iron valve boxes for covering 4" thru 10" valves for water or gas. Rugged construction for lifetime service. 5¼" shaft. Extensions as required.

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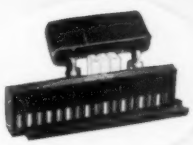

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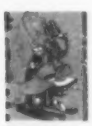


## Algae of Importance in Water Supply

This reprint, prepared in close collaboration with U. S. Public Health service authorities, includes for the first time in magazine history, full and accurate color plates for identification of types of algae most important in water supplies—those which cause tastes and odors, clog filters or are likely to be found in clean or polluted waters. Color plates of this quality have never before been available to simplify the job of algae identification. The color plates are printed on one side of a page only, and are thus suitable for framing or mounting. The binding will permit the color plates to lie flat. Order your copy today.

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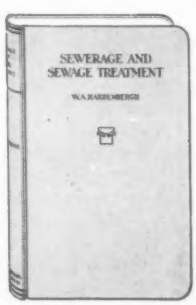
## Sewerage and Sewage Treatment

**By COL. W. A. HARDENBERGH**

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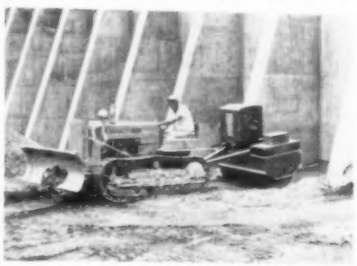
It shreds a 42-inch swath and is ideal for mowing fence rows, stalks, road shoulders and parks. The mower is V-belt driven and the height of cut is adjusted by the lift mechanism of the tractor. A leaf mulching attachment is also available. For further information write to Wood Brothers Mfg. Co., Oregon, Ill., or circle **No. 1-21** on the coupon.

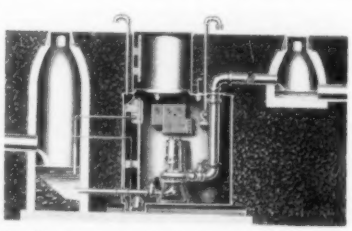
### Vibratory Rollers Produce Deep Compaction

The Models VR 28 W and VR 32 R vibrating rollers announced by Essick will compact layers of granular materials from 10 to 24 inches in thickness and will give compaction that will pass AASHO specifications. The 54-inch Model VR 54 T vibrating roller, weighing 3,225 lbs. is especially adapted to produce the required degree of compaction of earth fills around bridge abutments and building foundations. This model can also be used in the vibration of fine materials for water bound base for macadam. For additional information write Essick Mfg. Company, 1950 Santa Fe Avenue, Los Angeles 21, California or circle **No. 1-22** on the coupon.



### Prefabricated Underground Pumping Station

The Zimmer & Francescon prefabricated automatic lift station for underground installations is for use with existing sewerage systems and for handling extensions to existing sewer lines. The entire pumping unit is assembled and welded at the factory, using heavy steel plate, reinforced against exterior hydrostatic forces. Dimensions are usually not



**Sectional view** shows design of the prefabricated automatic sewage lift station

less than 7 ft. in diameter and 7 ft. high and there is a 3-ft. diameter entrance tube at the top. The station capacities can be as high as 600 gpm at heads up to 80 ft. The plant housing is usually shipped in two sections and joined on the job by welding. For full data write Zimmer & Francescon, Moline, Illinois or circle **No. 1-23** on the coupon.

### Dual Purpose Hi-Reach Aerial Platform

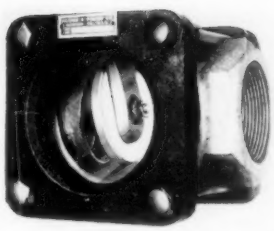
This versatile dual-purpose unit announced by Elliott may be used either as an aerial working platform or, with the platform removed, as a live boom. It has a lifting capacity to 4000 lbs. and a reach to 60 feet. Its safety factors and its dual purpose design are claimed to make it unique in aerial equipment. The Hi-Reach has many practical uses in the construction and maintenance fields. Operation is by hydraulic power (including the winch); the power is supplied via a power take-

**Hi-Reach** unit lifts 60 feet for convenient aerial work

off from any standard long wheel base 2-ton truck. For more data write Elliott Mfg. Company, 503-7 Redick Tower, Omaha 2, Nebraska, or circle **No. 1-24** on the coupon.

### Sight Flow Indicator Provides Check of Back-Flow

A sight flow indicator which combines flow indication with positive check of back-flow has been introduced by Fischer & Porter. The device has a self-aligning soft seat flapper which prevents back flow. Two ½-inch thick glass windows on opposite sides of the body fitting show clearly whether or not there is a flow. Standard sizes are for 2-inch pipe, with an operating pressure



rating of 250 psi and for 1½-inch pipe with a rating of 300 psi. For full details write Fischer & Porter, Hatboro, Pa., or circle **No. 1-25** on the coupon.

### Electronic Pipe and Cable Locators

For more convenient use, the circuitry of this electronic pipe and cable locator is etched onto a phenolic material. Construction permits the interchanging of transmitters of one instrument with receivers of another, an important feature among large operators using a number of line locators in maintenance and construction work. Sub-surface pipes, cables, etc., under frozen ground, ice or water, may be located. For more data write Wilkinson Products Co., Pasadena, Calif., or circle **No. 1-26** on the coupon.

### New Marker Features Double Lines, Automotive Steering

A completely new model, self-propelled line marker, featuring either solid or intermittent lines and automotive steering, has been announced by the M-B Corporation. The automotive type steering makes the three-wheeled LineMaster extremely maneuverable and eliminates the necessity of skid-steering for a perfect curve. It is equipped with an 18-gallon paint tank with a full opening top. Paint guns are standard, air operated and easily visible to the operator while marking. There is ample power and air reserve for continuous double line work, marking lines from 3 to 6 inches wide, regular or reflective, solid or intermittent. For further information write M-B Corp., New Holstein, Wisc., or circle **No. 1-27.**

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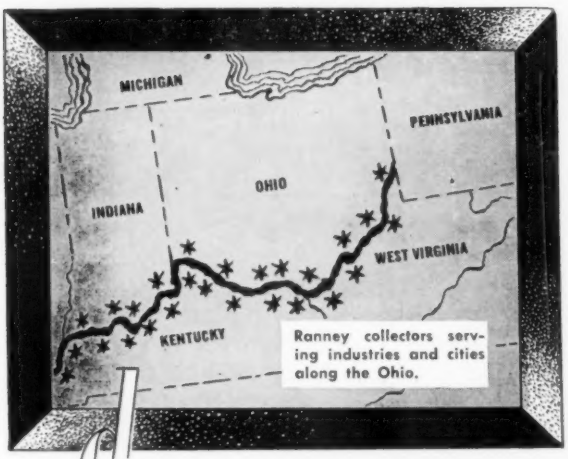


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## 208.8 MILLION GALLONS PER DAY

**Here is more proof** that the RANNEY METHOD is the most effective, economical means of collecting huge volumes of naturally filtered, non-turbid water.

**43 collectors,** representing 9 chemical plants, 2 distilleries, 2 Ordnance Plants, 1 Steel Company, and 3 Municipal Water Supplies, are now producing an abundant water supply by infiltration. Results here, as in so many areas, are highly satisfactory.

**Take advantage** of this low-cost insurance against water shortage problems, without the expense of filter plants and treatment stations.

Dept. PW-4

**RANNEY METHOD**

Water Supplies Inc.

*Water Supply Engineers and Contractors*

841 Alton Columbus 19, Ohio

Associate: Ranney Method Western Corporation

## in fair weather

## or foul

## (MB) sweepers keep . . . tractors busy year 'round

Your tractors do double duty with M-B Sweepers keeping streets and sidewalks safe and clean during all seasons.

In Winter your tractors are put to work sweeping snow from streets, parking areas and skating ponds. Milder weather brings multiple uses on all public thoroughfares.

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Longer wearing fiber brushes — 5′ & 6′ widths — 30° sweeping angle; hydraulic controls raise brush 8″ to clear curbs and obstructions; dust hood (easily removable for snow sweeping) keeps dust down to provide better operator vision; floating action broom compensates for uneven brush wear and follows surface contour; brush quickly removable for drawbar work; broom may be disengaged while traveling; sprinkler attachment available; M-B sweepers completely engineered and ready to mount on most popular tractors.

**More Streets and Roads Are Kept Clear With M-B Sweepers Than Any Other Kind!**

PACKER BODIES • LINE MARKERS • SWEEPERS • PAINTS AND BEADS

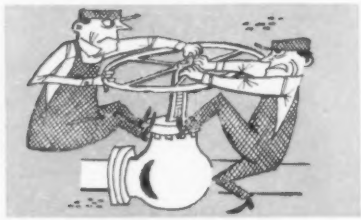
(MB) CORPORATION
NEW HOLSTEIN, WIS.

MANUFACTURERS OF QUALITY MUNICIPAL AND CONSTRUCTION EQUIPMENT SINCE 1907


Now's the time to mail this month's Readers' Service Card.

*Do you have to operate your* **PLUG VALVE** *like this?*

*Or do you have to use* Two Men *to operate your* **GATE VALVE** *like this?*



*then install the*
**G-A FLOWTROL VALVE**
*which can be operated*
**LIKE THIS**

*Standard-built for pressures up to 300 psi*
*Built to order for higher pressures*
*Sizes* **2"** *to* **36"**
**WRITE FOR TECHNICAL FACTS TODAY**

GOLDEN ANDERSON
*Valve Specialty Company*
1.4 RIDGE AVE., PITTSBURGH 33, PA.
Designers and Manufacturers of VALVES FOR AUTOMATION

# WORTH TELLING

**by Arthur K. Akers**

★ 1955 was a good year but we are betting on 1956 to be even better. May you find it so, every day and in every way!

★ WESTERN MACHINERY CO., San Francisco, announces appointments which include those of H. J. Mayer, executive vice president, and W. H. Newton, general sales manager.

★ EMORY M. FORD is honored with re-election as chairman of the board of directors, Portland Cement Association.

★ INFILCO Inc. has been awarded the contract for installation of the world's largest high-rate water treating plant in Omaha. Burns and McDonnell are the engineers.

★ HENRY J. BARBOUR succeeds L. A. Harlow as manager of advertising and public relations, Fairbanks, Morse & Co.

Mr. Barbour

Mr. Parnell

★ LEONARD C. PARNELL is promoted to manager, Minneapolis office, American Cast Iron Pipe Company, succeeding D. W. ("Doug.") Wallace, retired.

★ LE ROI DIVISION, Westinghouse Air Brake Co., has just completed extensive new branch facilities at 5000 45th Ave., West, Tulsa.

★ CHICAGO BRIDGE and Iron Co. advances Robert S. Chamberlain to its San Francisco sales office, Arthur G. Albertson to Los Angeles, and Julius D. Holmquist to Philadelphia.

★ RADIATOR SPECIALTY CO., Charlotte, N.C., makers of those yellow rubber traffic cones you see everywhere, names David Hoffman general sales manager.

★ CHARLES JENSEN is named northern and eastern regional sales representative, The Atlas Mineral Products Co., for their water and sewer pipe jointing compounds.

Mr. Jensen

Mr. Gulley

★ ROCKWELL MFG. CO., valve and meter division, announces William F. Gulley promoted from Seattle to district manager at San Francisco. Roy E. Nimitz of San Francisco succeeds him in Seattle.

★ SYNTRON CO., Homer City, Pa., will now be operated as a Link-Belt Co. subsidiary.

★ SEAMAN-ANDWALL CORPORATION, Milwaukee, manufacturers of road stabilization equipment, announce the purchase of the Century line of cement and materials spreaders designed and originally manufactured by Century Engineering Co., Waukesha, Wis.

★ WARREN FOUNDRY AND PIPE CORPORATION will celebrate its one hundreth anniversary next spring with the opening of a modern new shop at the Phillipsburg, N. J. plant to make de Lavaud cast iron pipe in sizes 4 through 12 inches in diameter.

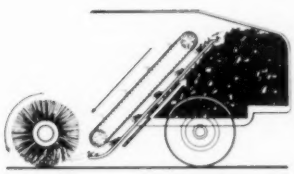
★ FLINK CO, Streator, Ill., has purchased the motor truck snow plow division of Baker Mfg. Co., Springfield, Ill., from Allis-Chalmers Mfg. Co.

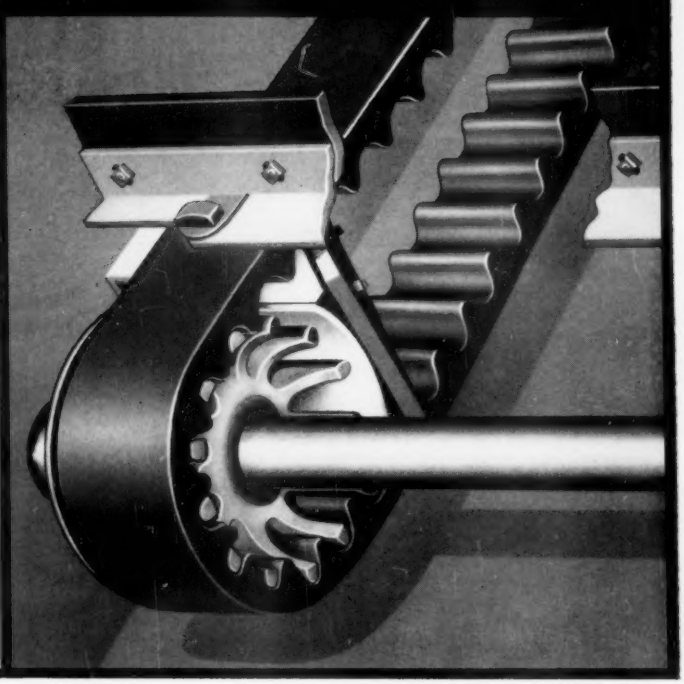
★ JOE: "Is it true that jungle beasts will not harm you if you carry a torch?"
MOE: "Depends on how fast you carry it."

—Marion Groundhog

# *NOW!* GUARANTEED 6,000 MILES!

## RUBBER DRIVE CHAINS FOR DIRT ELEVATOR ON WAYNE SWEEPERS!





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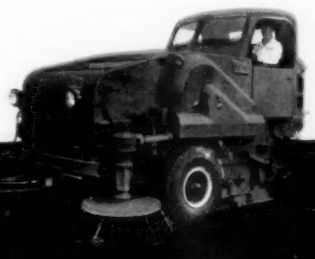
Never before a guarantee like this for any part of dirt lifting mechanism on a street sweeper. Only Wayne dares make it, because only Wayne has rubber drive chains that outwear steel. And only Wayne is designed to handle uncontrolled quantities of debris.

Built around a core of high alloy steel woven cables, these tough rubber drive chains withstand the abrasive wear of sand and dirt. Nothing compares in strength, stamina and backbone needed for long, uninterrupted service. *This has been proved in 6,000,000 miles of sweeping!* Downtime for repair or replacement is reduced to a minimum. Sweeping time reaches a high not equalled in any other sweeper. So when you order *your* next sweeper, specify rubber drive chains.

*Write for descriptive literature*



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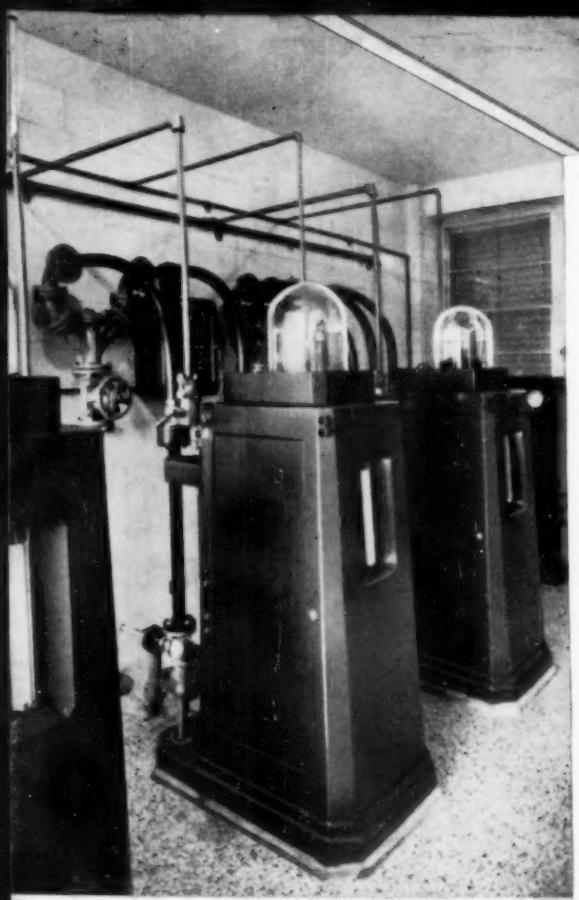
**WAYNE MANUFACTURING CO.**
1220 E. Lexington St., Pomona, Calif.
472 Highway 1, Newark, N.J.

*World's Largest Manufacturer of Sweepers for Cities and Industry*



CITY OF DALLAS
TEXAS
DEPARTMENT OF WATER WORKS
2125 COMMERCE STREET

TELEPHONE RA-2481

2605 Shore Crest Drive
Dallas 19, Texas
January 20, 1955

Wallace & Tiernan
1112 National City Building
Dallas 1, Texas

Gentlemen:

In answer to your recent inquiry, the Water Purification Division of the City of Dallas Water Department purchased its first chlorinator of the Wallace and Tiernan Water Diaphragm Type in April 1924.

Twelve chlorinators employing the water diaphragm principle have been purchased from your company for use in our system to protect and insure our water supply against the transmission of water borne diseases.

Just recently we completely reconditioned for the first time one of the chlorinators that had been in continuous service for over 17 years.

The performance of all these machines has been excellent and they have required only routine maintenance for dependable service.

Very truly yours,

Ben L. Grimes

Ben L. Grimes
Supervisor
Water Purification Plants

# "....CONTINUOUS SERVICE *for over 17 years."*

In Dallas, Texas, The Water Purification Division recently "reconditioned for the first time one of the chlorinators that had been in continuous service for over 17 years", according to Mr. Ben L. Grimes, Supervisor, Water Purification Plants. This dependability and long life result not only from proper design, but from the selection of the right parts and materials for every specific purpose.

Since 1913, W&T research has consistently sought out new designs, principles and materials. Every new development is placed under rigid field tests to prove it can meet the exacting standards that dependable and economical chlorination demands.

When you depend on W&T equipment, you have the assurance that 40 years of experience in the chlorination field is being used to bring you the best in design, parts and materials — selected for long life and dependable service.

*"Make Your First Choice Equipment That Lasts."*

**WALLACE & TIERNAN INCORPORATED**

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